

PUBLIC WORKS

*city
county*

*september
1948*

OHIO STATE
UNIVERSITY
SEP 1948

some of the articles
in this issue

Water Metering Solves
Financial Problems

Cold-Mix Bituminous
Pavements

How to Use Hypochlorites

New Method of Heating
Sludge Digesters

Refuse Collection Practices
in Tennessee

The Highway and Airport
Digest

The Sewerage Digest

The Water Works Digest

PROBLEM:
STERILIZING A VARIABLE
FLOW WATER SUPPLY
UNDER PRESSURE



SOLUTION:
%PROPORTIONEERS% AUTOMATIC AND
%PROPORTIONAL CHEM-O-FEEDER!

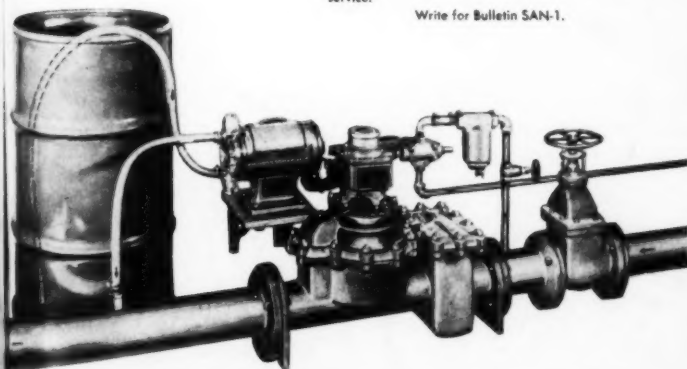
Install %Proportioneers% Automatic and Proportional Chem-O-Feeder and a standard water meter. It is only necessary to know minimum, average, and maximum flow to be sterilized and the pressures against which the chemical will be injected. All flow is measured by the mechanical water meter and %Proportioneers% equipment starts, stops and stops dosage of chemical in step as the flow comes on, fluctuates and tapers off. The %Proportioneers% Low Pressure Chem-O-Feeder shown is designed for gravity water supplies against pressures up to 100 p.s.i. Installation is simple and our nearest

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RESULT: Fully automatic sterilization of water supply, with chemical fed in strict proportion to flow, without dependence on electricity or other source of power. The only attention required is the occasional refilling of solution tank and checking the chlorine residual to adjust dosage for any variation in the chlorine demand of raw water.

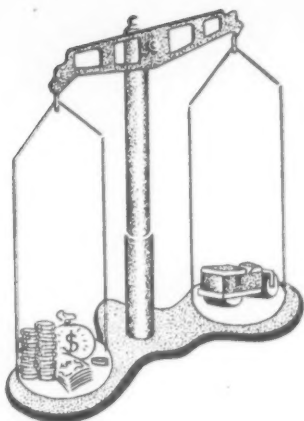
CONCLUSION: Whatever your water treating problem, %Proportioneers% can help you; ask us for recommendations and quotations. Our experience from over 23,000 installations is at your service.

Write for Bulletin SAN-1.



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the Balance
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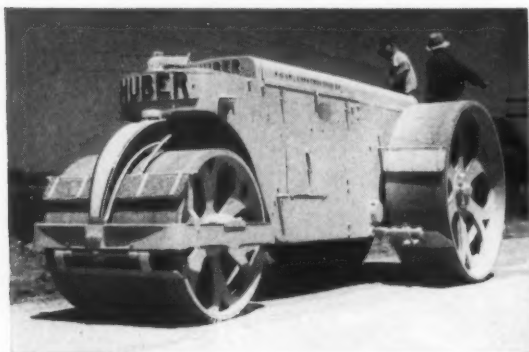
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Huber's versatile Road Maintainer—a lift loader, berm leveler, bulldozer, patch roller, snow plow, or rotary broom all in one.

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Huber's highly maneuverable Tandem Rollers lend themselves to many special tasks. Variable weight models from 3 to 14 tons.



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ROAD ROLLERS
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Precision Engineered
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15 Years of
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THE COMMINUTOR

Is Specifically Designed to Screen
and Cut Sewage Solids Under Water

From the Mediterranean to the Philippines; from the Arctic Circle to Australia, wherever there is modern sewage treatment, you will find Comminutors. Such world-wide acceptance is based on a machine that efficiently and effectively performs a service unmatched by any other type of equipment.

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The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

If you have work in the sewage treatment field, write today for the Comminutor Bulletin which gives complete engineering data.

CHICAGO

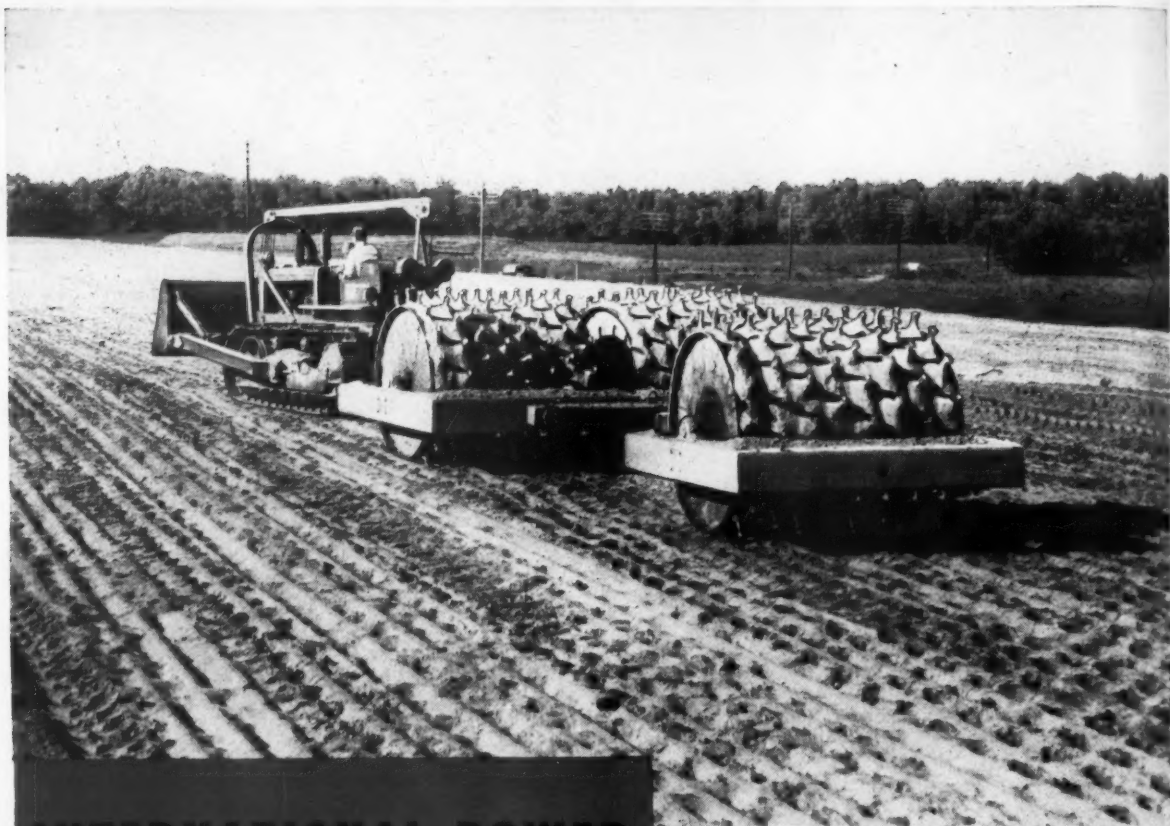
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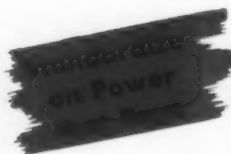
Consult your International Industrial Power Distributor about your airport expansion and maintenance problems. He'll be glad to help select the correct power and equipment for your needs.

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**CRAWLER TRACTORS
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Advertising Offices

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PUBLIC WORKS

*The engineering authority in the
city-county field*

Founded in 1896

Edited by

W. A. HARDENBERGH and A. PRESCOTT FOLWELL

SEPTEMBER, 1948

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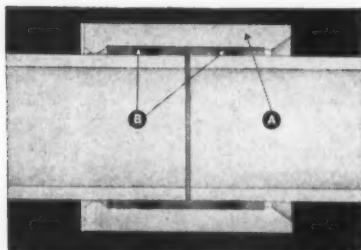
Engineering Facts about Johns-Manville TRANSITE PRESSURE PIPE *The Inyokern Earthquake*

WATER LINES are seldom required to withstand a test as severe as that to which a Transite® asbestos-cement Pipe installation was subjected at Inyokern, California, about two years ago. The Transite installation at Inyokern consists of over 300,000 feet of pipe and comprises the major portion of the water supply system for the vast Naval Ordnance Test Station located there.

During the early part of 1946, an earthquake of maximum intensity occurred in the Inyokern area. Shocks of great severity were felt throughout the immediate locality in which the Transite line was laid. Naturally, concern was felt at the Naval establishment for the safety of its water supply.

After the quake had subsided, crews were dispatched to repair whatever damage the lines might have suffered. A thorough search failed to reveal a single break or any evidence of leakage at any one of the 25,000 joints in the system. Subsequent careful check of pressures and measurement of water levels confirmed that the lines had remained intact.

The reason this Transite installation



This cutaway sketch shows construction of the Simplex Coupling used with Transite Pressure Pipe. It consists of Transite sleeve "A" and two rubber rings "B" which are tightly compressed between sleeve and pipe as the coupling is assembled.



This aerial view shows a portion of the Naval Ordnance Test Station at Inyokern, California.

was able to withstand this severe test is found in the inherent strength of the pipe and in the design of its Simplex Coupling, the standard coupling for Transite Pressure Pipe. Each of these couplings is a tight yet flexible link connecting one section of pipe to another and imparting to the line as a whole a degree of flexibility which enables it to "roll with the punch." Thus, shocks and vibrations are absorbed, stresses minimized to an unusual degree.

A factory-made joint which requires only assembly on the job, the Simplex Coupling derives its flexibility from its simple design. Consisting of a Transite sleeve and two rubber rings tightly compressed between pipe and sleeve, its

simplicity and ease of assembly are apparent from the accompanying illustration. Moreover, this coupling is readily checked for proper assembly as the line is laid—further assurance of tightness in each individual joint and in the line as a whole.

Probably your water lines will never be called upon to absorb punishment as severe as the Transite lines at Inyokern. But the same engineering advances which protected this Transite installation can be depended on to safeguard equally well against the stresses normally encountered in water line service.

For further information about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

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The Editor's Page

The New Look in Public Works

We like the looks of our new cover and we hope that our readers will like it too. It is, however, but an outward indication of the changes that we have been making steadily in PUBLIC WORKS. We believe that an engineering magazine can be attractive and easy to read, as well as helpful and valuable. We have been trying to accomplish all of these objectives.

Our new cover was designed under the direction of one of the best known artists in this line in the country. Many of the other changes we have made have been suggested by our readers, including larger and clearer type and a new format for the Digests, also starting with this issue. We are always glad to have suggestions—and even complaints, if they lead to doing something better than it has been done before.

We must rely largely on our readers for the articles that we publish each month. We are always glad to have contributions; they must be the best and most helpful that it is possible to have. We pay for all such contributions; more for the better ones. If you had a job that will help other engineers to do their jobs better, tell us about it.

The Sanitary Fill and Its Disreputable Relatives

Properly designed and operated, a sanitary fill does a good job of disposing of wastes. The trouble is that far too often it is neither properly designed nor properly operated. Then it deteriorates and tries to hang onto a vestige of respectability by a thin coating of dirt or ashes scraped over the surface, whereas thorough compaction of the refuse and a complete cover of dirt is necessary. A lot of cities are trying to kid themselves that they are traveling with high-grade folks when, in reality they are entertaining the disreputable relatives. It is not an easy job to operate a sanitary fill. It takes good equipment, sound operating practice, education of the workmen and a tough superintendent. Also, it costs quite a bit of money. Granted these, it's fine; without them, the old-time dump is just as good and costs less.

Selective Service and Engineers

The selective service law will, right now, affect few engineers, for most of the men who were graduated before or during the war years went into the service or are too old to be affected. But it is highly important that selective service shall not interfere with a free flow through the engineering schools of an adequate number of young men. During the war, we made the mistake of cutting down very materially on the number of men in engineering training; we tried to correct this all at once by the ASTP which perhaps helped, but was inadequate. We should not make the same error the second time, and reduce still further the critically small number of engineers.

Probably the best way to avoid this error is to be sure that Selective Service has nothing to do with

this type of deferment. The job of Selective Service is the procurement of "bodies." It can do that job, but it cannot also provide the knowledge and judgment necessary to insure that there are enough men taking technical training to meet the needs of the nation. It failed miserably on this during the war. The job of determining the needs for scientific skills, and of insuring that these needs are met, should be delegated to the National Security Resources Board or other similar agency. It most certainly should not be left up to the hard-boiled and rather narrow-minded personnel of Selective Service. Engineers, and other scientific personnel, will get exactly nowhere in that case.

Research Must Be Applied to Be of Real Value

Research has so well demonstrated its worth that only old fogies, so to speak, question its value. However, to be of real usefulness, the results of research must be applied to our problems of everyday life. If this is not done, much, or maybe all, of its value is lost.

During the past few years, the job of selling research to industry has been developed so that our research man is often a pretty good salesman—for research. Too often, he does not complete the selling job by convincing industry of the necessity of going on and making available the fruits of research. In some cases, research has been the style—something the up-and-coming or progressive firm must have—with little thought to cashing in on this research by putting its conclusions to work.

First must come research; then the process of streamlining and harnessing it for beneficial use; finally comes its application to better living, better streets, safer water, better waste disposal, or whatever it is designed to do. If we omit any of these steps, we lose the benefits of what has been done. And in the long run, if research doesn't produce benefits, it will cease being stylish, or even a necessity.

The Potato Test

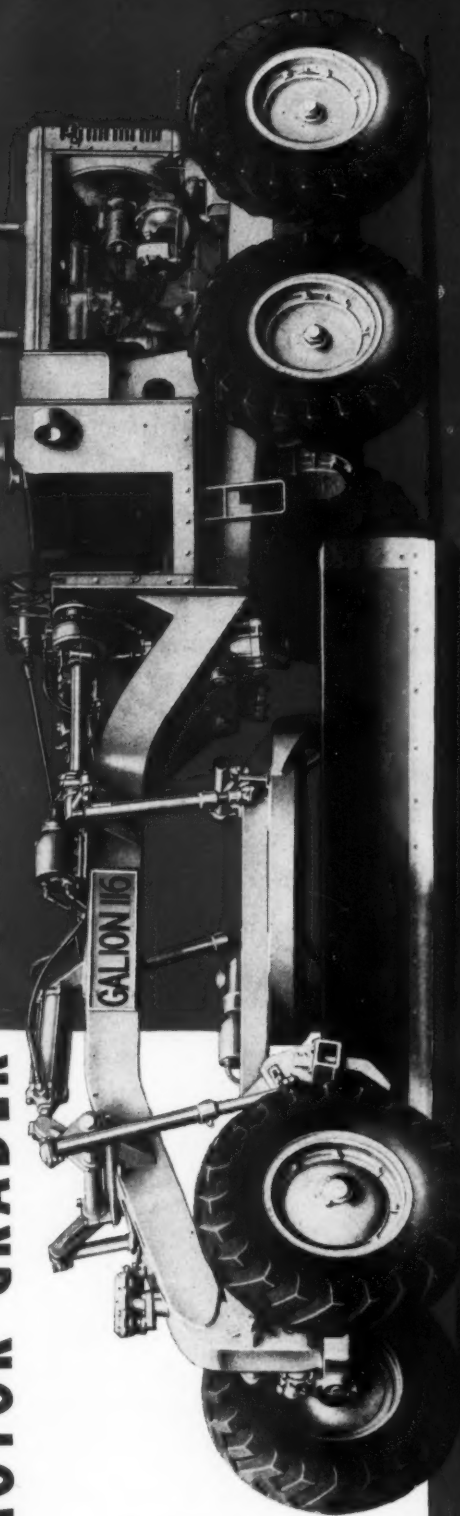
In preparing for publication an article from the CEC Bulletin telling of the results of using salt or brackish water in concrete construction in the Pacific during the war, the editor was reminded of the practices on the old Erie Canal some sixty years ago. Work had to be done during the winter, because the canal was in use during the summer. It was standard operating practice to put enough salt into the mixing water to float an Irish potato, and the foreman always carried a potato around in his pocket for test purposes. This practice was designed to prevent damage to the concrete from freezing. Apparently the salt did its job and did not affect the quality of the concrete which, by the way, was made with natural cement. No, your editor was not among those present. This is strictly heresay, but from one who was present.

It's NEW!
No. 116
GALION
MOTOR GRADER

100 h-p.
for Extra Heavy-Duty Service

THE GALION IRON WORKS & MFG. CO
 General and Export Offices Galion, Ohio, U. S. A.

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 No. 315



Letters

**A COMPLIMENT AND
 A COMPLAINT**

To see the words "The Editor Apologizes" in large type is a rare experience. Your editorial, under that title, in the March issue of PUBLIC WORKS was both amusing and pertinent. It is seldom, indeed, that a sense of humor is apparent in our technical literature. I did enjoy your editorial—enough to want to tell you so.

Since I am writing, however, it provides an opportunity to voice my only adverse criticism of your editorial practice in PUBLIC WORKS: There *must* be a better method of providing the bibliography for the Sewerage and Water Works Digests than the one now used. I do realize that problems of make-up must be considered; but, for those who cut up the magazine for filing, the present practice is sometimes very frustrating.

The second paragraph of this note is not intended to detract at all from what is said in paragraph one. There is, however, a connection between the two: perhaps it could be said that you *are* publishing Timewasters!

HARRY A. FABER,
 Research Chemist,
 The Chlorine Institute, Inc.

Referring to the complaint, we believe it is well taken and are this month putting into effect a suggestion in regard to THE DIGESTS which Mr. Faber made in a later letter. We think it is an improvement and thank him for his interest and assistance. The Editors.

**WATER FOR AIR
 CONDITIONING**

The increasing number of air conditioning and refrigerating systems being installed that are using water from the public supply for cooling are imposing a serious peak demand. This is particularly burdensome in view of the fact that the maximum load for these purposes occurs at the same season of the year when other uses are at their peak.

In the case of Easton, Maryland, the only available supply is from wells, our most reliable supply being from wells 1,000 to 1,100 feet deep, and there is no positive assurance that this supply is unlimited.

In view of the above we are endeavoring to secure information as to the general practice regarding such installations. If you have collected any data with regard to this problem we would appreciate getting it. We are particularly interested in general practice with regard to the following:

1. Is the consumer required to install recooling equipment, cooling tower evaporative cooler, etc., and at what limit of demand is this required.
2. Is this limit determined by the capacity of the cooling system being served or by measurement of the de-

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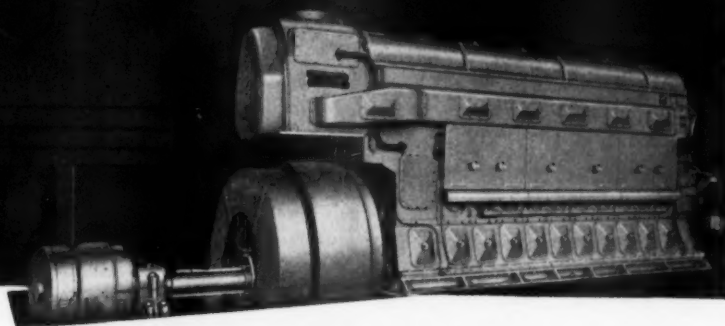
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Opposed Pistons Working Together



For Finer Diesel Power

Two pistons in each cylinder, driven apart by a central combustion . . . working together to produce *more* power per cylinder, *more* power per pound, *more* power per foot of floor space . . . these are the advanced benefits of Fairbanks-Morse Opposed-Piston, Two-Cycle Diesels. They have no valves, no cylinder heads, 40% fewer working parts . . . and an earned reputation for delivering low-cost power in all classes of heavy-duty service.

Fairbanks, Morse & Co., Chicago 5, Ill.

When it comes to Diesels . . .

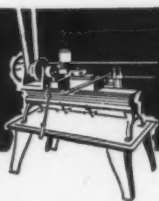


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A name worth remembering

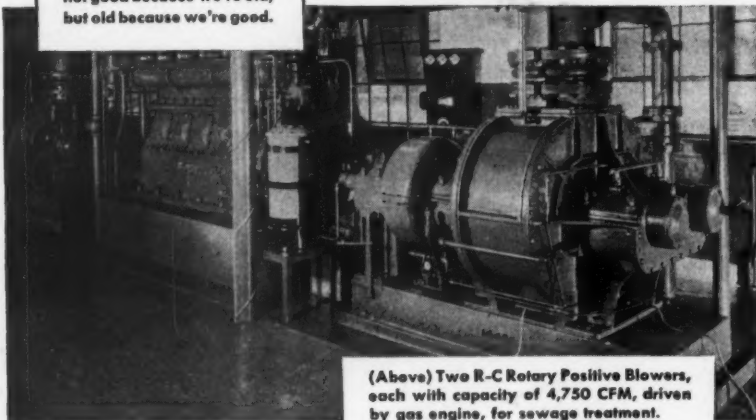
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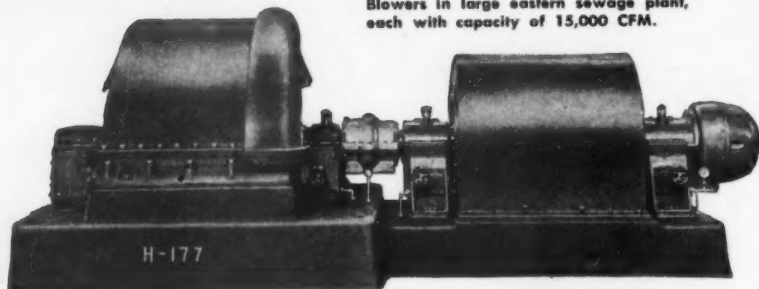
The first successful turret lathe and the first Roots Blower were built in the same year . . . 1854. We're not good because we're old, but old because we're good.

Exclusive Service... R-C dual-ability



(Above) Two R-C Rotary Positive Blowers, each with capacity of 4,750 CFM, driven by gas engine, for sewage treatment.

(Below) One of three R-C Centrifugal Blowers in large eastern sewage plant, each with capacity of 15,000 CFM.



You obtain an important, exclusive advantage when you consult us about problems of moving air or gas. That is, our *dual-ability* to supply either Centrifugal or Rotary Positive units.

This *dual choice* allows you to match equipment exactly to your needs, in capacities, pressures and other characteristics. You can have standard Rotary Positive units from 10 CFM up to 50,000 CFM, or Centrifugal units from 2,000 CFM up to 100,000 CFM. You save time, trouble and money by using one supply source.

So, utilize this exclusive *dual-ability* by consulting us on all your blower or gas pump requirements. The economy and dependability of R-C Blowers have been proved for almost a century.

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mand for water in gallons per minute or other unit.

3. Is a "readiness to serve" charge made to cover fixed charges for the investment required to serve this demand considering the seasonal nature of this service.

4. If water is charged for by meter rates, are the yearly rates applied or are special rate schedules used.

It has been our practice to apply the regular yearly schedules for these installations, but there is a question as to whether this is altogether fair to the yearly customers in view of the seasonal nature of this service.

RALPH A. TOWNSEND,
Secretary,
Easton Utilities Commission,
Easton, Md.

Will our readers who have helpful information for Mr. Townsend write directly to him; however, we would be glad to have copies of data for our file. The Editors.

CHARGES FOR FIRE PROTECTION

We are very much pleased to find the articles in PUBLIC WORKS entitled "How Cities Charge for Private Fire Protection Services." We established such a charge here in Manchester several months ago and are being sued by a group of our manufacturers and commercial companies to prevent us from collecting such charges. If you have, or know, where I can find information regarding cities which have maintained fire service charges we would appreciate very much receiving this information. No amount of selling or argument seems to convince these people that this is a fair and legitimate charge.

P. A. SHAW, Superintendent,
Manchester, N. H., Water Works

We are sure that Mr. Shaw will appreciate receiving pertinent information over and above that which appeared in PUBLIC WORKS. The Editors.

SMALL SEWAGE TREATMENT

I would like to have the five previous articles Nos. I to V on Small Sewage Treatment Plants which have been published in your magazine. I will save the articles from VI on as they appear in the magazine.

Please bill the City of Mill Valley, Department of Public Works.

A. E. ALMCRANTS,
Public Works Engineer,
Mill Valley, Calif.

This is typical of a great many letters on this subject. All copies of the issue (Feb. 1948) containing the first installment have been exhausted; other issues are being depleted rapidly. We are contemplating issuing these articles in a reprint of about 20 pages. It would help if our readers who may wish copies will let us know so that we may plan the reprints. Printing costs too much today to print more than will be needed. There will be a small charge for the reprints—if printed. The Editors.



EVERDUR SCREENS in Westchester's Long-range Program

NEW YORK's Westchester County is currently embarked on a long-range sewerage plant modernization and improvement program, under the direction of Mr. J. C. Harding, Commissioner of the county's Department of Public Works.

Involved in this work are extensive replacements for the Blind Brook, Mamaroneck and Yonkers Sewage Treatment Plants. Because of Westchester's favorable experience with Everdur* over a long period of years, these copper-silicon alloys are being specified for many applications. The Everdur screen shown above is one example at Blind Brook (Rye, N. Y.). The milled Everdur plates were fabricated by Hendrick Manufacturing Company, Carbon-dale, Pa.

And in hundreds of other communities during the past 20 years, extensive use of Everdur

Copper-Silicon Alloys in water works and sewerage treatment installations has proved a long-run economy. In every installation the high strength and toughness of these alloys combine with their corrosion resistance to provide outstanding serviceability. Ease of hot or cold working, forging, machining and welding are factors in speedy, economical fabrication.

For more detailed information, write for Publication E-11.

*Reg. U. S. Pat. Off.

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THE AMERICAN BRASS COMPANY

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Subsidiary of Anaconda Copper Mining Company
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THE NATIONAL GUARD DEFENDS AMERICA—JOIN NOW!

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CENTRILINE

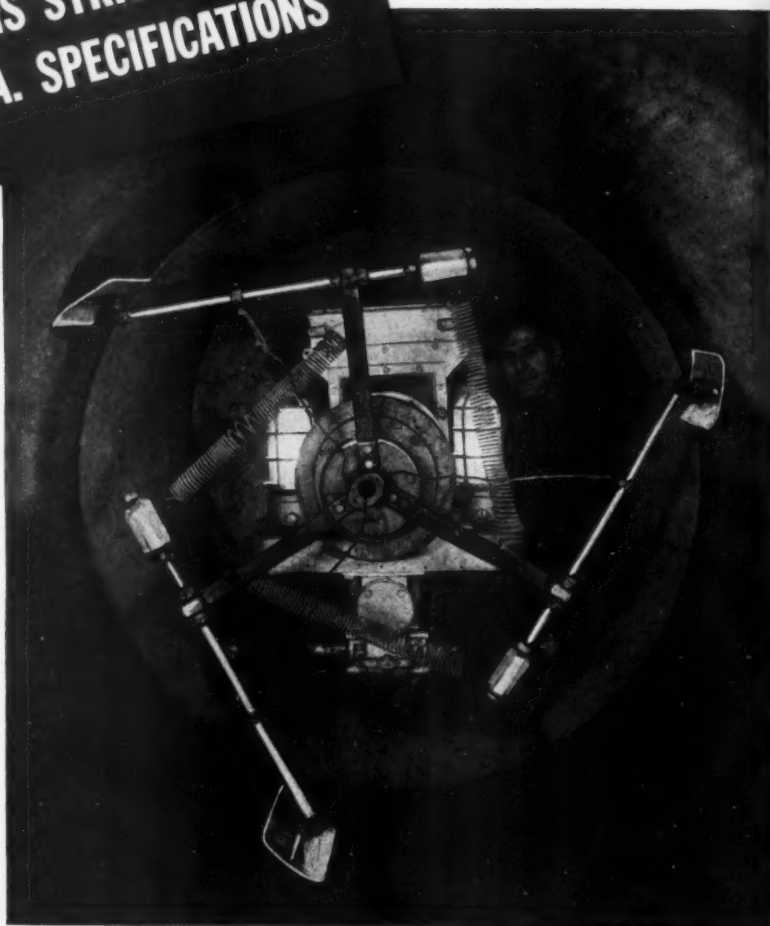
CONFORMS STRICTLY
WITH A.W.W.A. SPECIFICATIONS

▶▶▶ PIPE LINING
FACTS NO. 3

▶▶▶▶ The Standard Specifications for cement-mortar protective coatings issued by the American Water Works Association provide: "Interior of the entire line, including both curves and tangents, shall be by centrifugal machine . . . the machine shall apply the mortar by centrifugal action without the use of compressed air and follow its application by automatic trowelling to a uniform thickness and smooth finished surface."

The strict adherence to these specifications by Centriline insures a continuous, dense, smooth lining, applied without rebound that means restored carrying capacity perpetually sustained and longer life to mains. If pipelines are losing efficiency it is time to consider Centrilineing. Our engineers stand ready to assist you.

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CENTRILINE CATALOG



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Centrifugally Applied

In Strict Conformity with A. W. W. A. Specifications



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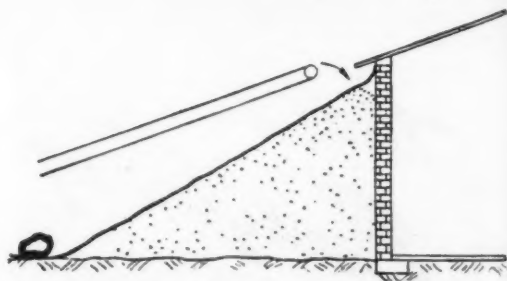
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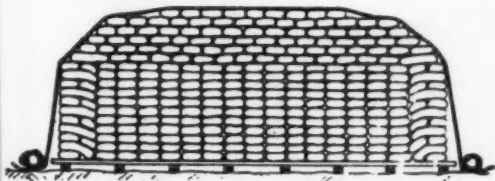
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The amazingly simple stages of pick-up, hauling and dumping the detachable containers are shown in the three photos above. In the top photo, driver has backed the truck hoisting unit up to the 8 cu. yd. apartment type container, attached two chains and returned to the hydraulic controls in the truck cab. In center photo, container has been hydraulically lifted into carrying position ready for hauling to disposal area for automatic dumping as shown in the bottom photo.

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With the Dempster-Dumpster System, your city can "tailor" rubbish collection to meet the output of any given section, regardless of the volume. Here's how it works. Enclosed rubbish containers, such as the one shown below are placed at collection points in business districts, apartment and housing areas, at schools and at factories. Once the rubbish is placed in these containers, no wind or animal can scatter it, no rats or flies can contaminate it. As these containers are filled, a Dempster-Dumpster truck hoisting unit, operating on scheduled rounds, picks up each container hydraulically, hauls it to and dumps it at the disposal area, then returns the empty container to its original position. One truck and one man, the driver, handle the entire operation at a tremendous saving in time, money and equipment. Why not write today for complete information.

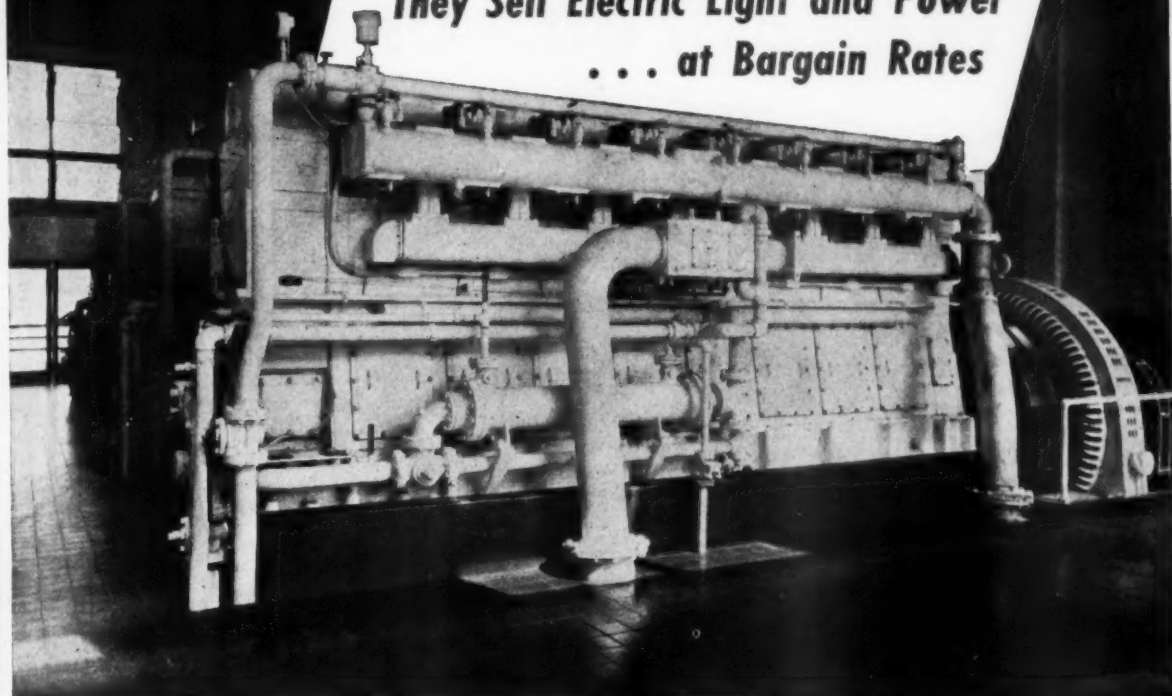


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They Sell Electric Light and Power
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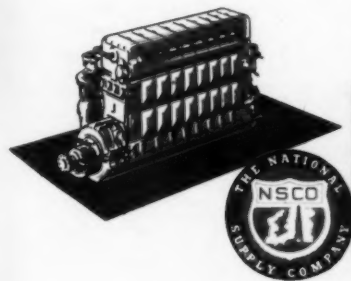
TEN years ago, the folks in Robstown wanted a dependable source of power. They got it...with two 6 cylinder, 525 hp. and two 8 cylinder, 700 hp. Superior Diesel Engines.

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**Only Superior Diesel Engines
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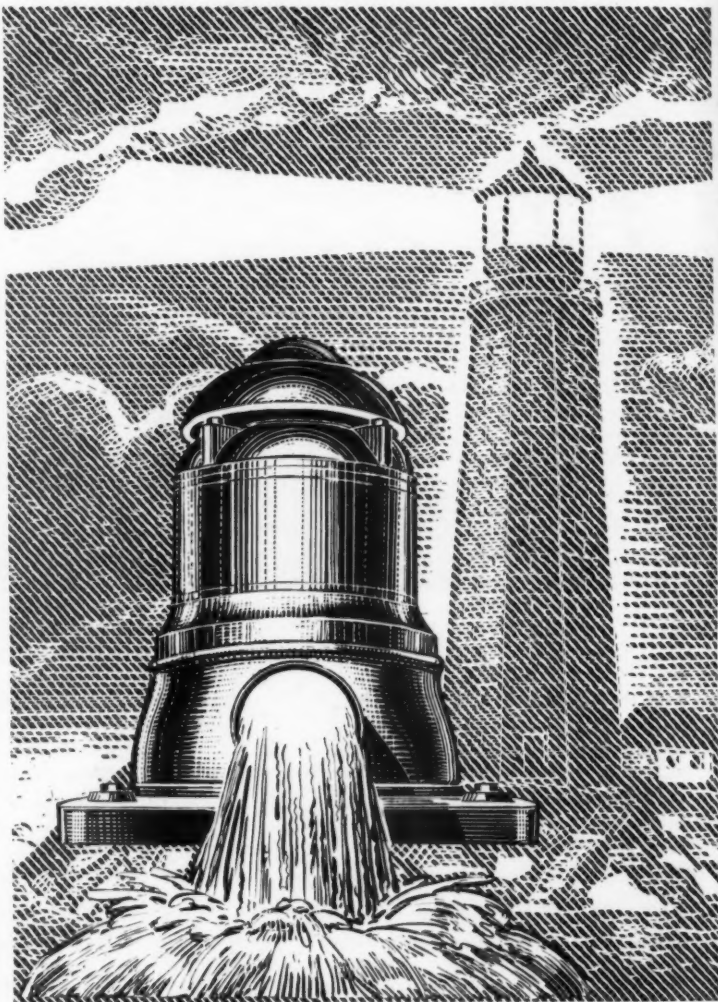
There is more genuine old fashioned quality in a Layne Well Water System than today's buyer has a right to expect. We've been building them for over sixty-five years and know that we would catch "Hail Columbia" if every little gadget wasn't tough enough to last. But right along with quality, we have done a mighty good job on improving efficiency—constantly stepping it higher and higher.

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A lot of cities, manufacturers, railroads, etc., use Layne Well Water Systems exclusively and will consider no other kind. They seem to know that they are getting a mighty big dollar's worth of real value.



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When you need special information—consult the READERS' SERVICE DEPT. on pages 77-81

An Interesting Chlorinator Installation

M. J. Shelton, General Manager and Chief Engineer, and L. L. Flor, Chemist

La Mesa, Lemon Grove and Spring Valley Irrigation District

THE La Mesa, Lemon Grove and Spring Valley Irrigation District serves several communities as well as a considerable rural area in San Diego County, Calif., easterly of the city of San Diego. This area is growing very rapidly. The water use is predominantly domestic although considerable is still used for irrigation of avocado and citrus crops. The District has a balancing reservoir, known as Grossmont Reservoir, located within the central part of the area served and from which the water is delivered to the majority of the domestic consumers. In the past, treatment was by means of a manual control chlorinator but with the added population, this proved unsatisfactory because of the wide range of water flow. It was impossible to maintain a continuous check on chlorine residuals and therefore the chlorinator was set for the maximum expected water usage, the result being overdosage as a common occurrence.

On October 1, 1947, the installation of a new Type MASV Wallace & Tiernan chlorinator was completed. It has a capacity of 400 pounds per 24 hours and is actuated by a new type converter regulated by a stand-



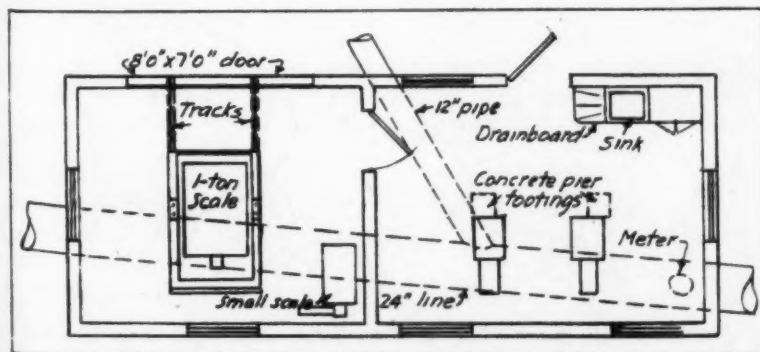
The chlorinator building, left, showing chlorine container in place. The pump house is at the right.

ard Sparling 24" mainline meter equipped with a special takeoff in place of the regular register. A flexible cable runs to the converter inside the chlorinator house from the takeoff. The vacuum lines from the aspirator to the converter and from the converter to the chlorinator are made of copper gas line for neater and easier construction.

Location of the new building was governed by the existing 24" main and takeoff to the pump house which delivers to higher levels. It was necessary to install the chlorinator below

the dam and ahead of the pump suction. There was just enough room to accomplish the installation by placing of the building straddle of the 24" line. The building is complete with a cylinder room large enough for a ton cylinder as well as a 100 or 150-pound cylinder on small scales.

Attention is called to the method of placing the ton cylinder on the scales and the rotation of the cylinder. It is unnecessary to lift the cylinders as the truck bed is at the floor level of the cylinder room and the truck is located so as to permit rolling the empty cylinder onto the empty portion of the truck; then the truck is moved back until the full cylinder on it is in line with the scales. Then the full cylinder is rolled into the building, onto the rollers of the scales and placed into position for the valves. The screw jacks are next turned, letting the weight of the cylinder onto the scales. Allowance has been made for a future second chlorinator. Also, a small laboratory is provided in that a sink with drain boards and several cabinets have been built in. The building was designed by the District and constructed by force account.



Layout of chlorinator building.

WATER METERING

Solves Milan's Financial Problems

R. T. HOSMON

Superintendent, Milan, Tenn., Electric and Water Dept.

THE waterworks pumping station at Milan, Tenn., in Jan., 1946, consisted of two 500 gpm units, which pumped from wells through an aerator into underground reservoirs. From the underground reservoirs, centrifugal pumps, each rated initially at 500 gpm, delivered directly into the mains of the system. The master flow meter was located on the effluent side of the centrifugal pumps. The demand at this time was averaging 800,000 gpd, which exceeded the capacity of either of the two wells. The better of these wells could deliver about 450 gpm or 648,000 gallons per 24 hours. This, in itself, was a dangerous situation in the face of possible mechanical or other failure of either well. Both of the centrifugal pumps, whose capacity had also been reduced approximately 20%, had to be operated almost continuously to meet the demand, but they did not offer so serious a threat in case of failure, as there were emergency gasoline driven standby pumps available. It should be noted that Milan has no overhead reservoir of any kind. For this reason sufficient centrifugal pump capacity had to be available 24 hours per day, and at least one pump had to be operating at all times. It was reasonably anticipated that the daily demand would increase as the summer season approached with the watering of lawns and gardens.

The financial condition of the system was typical of many small towns: Insufficient revenue to meet operating expenses with no sinking fund for emergencies, and the bonded indebtedness practically at the limit.

The situation as it existed at that time resulted in the necessity of doing one of two things: The first alternative was to add a third well; the second, to reduce wastage and consumption to actual needs. The fact that a wasteful usage of water existed can be observed from Chart 1, Fig. 1. It will be noted that during normal off peak times, as in the early hours

of the morning, the flow ranged well up between 400-500 gpm. Waste could be observed throughout the town in such usual ways as flowing yard hydrants, leaking commodes, etc.

Selecting a Course of Action

The course selected was to reduce wastage by metering the system. This decision was somewhat complicated by the fact that Milan had had in the past a very discouraging experience with water meters. Some time in the early 30's a partial metering of the town was undertaken. This was accomplished without the services of a competent engineer. Consequently, a cast-iron-body meter with an open gear train was selected. There was no corrosion control treatment of the water supply, resulting in trouble with corrosion and tuberculation. This coupled with the normal initial resentment against meters by the public caused the early abandonment of their use, and created a general opinion on the part of the public that meters were impractical with the water supply existing in Milan. This fact alone required considerable general public educational work.

Some immediate relief from the high consumption was undertaken by means of a personal appeal to those with obvious large leaks. One incident the writer recalls was that of 1 1/4" pipe supplying a small open tank, which in turn supplied a boiler. The 1 1/4" pipe ran continuously, 24 hours each day, the surplus water in the tank spilling over into a nearby ditch. By personal appeal this was corrected and, with the correction of other obvious leaks the consumption was reduced approximately 70,000 gallons per day.

Financing the Meters

The problem of financing the installation of the meters was no small one in face of the existing bonded indebtedness. The bond issue carried an interest rate of 3%. As encouragement to other small towns who may be faced with this same problem, I would like to mention that the results obtained sometimes are much more gratifying than anticipated. By pointing out the advantages of water meters to the Bonding Company, the entire bond issue was refunded, with an additional \$30,000, all at an interest rate of 2 1/2 per cent. This sav-

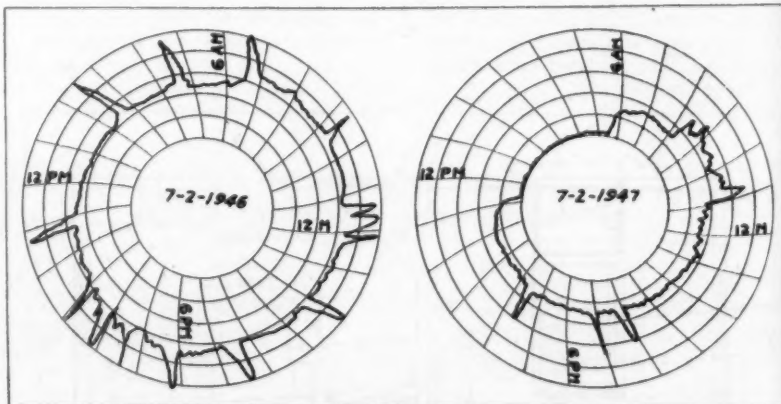


Fig. 1. Chart 1, left, flow for July 2, 1946, before metering 24-hour flow was 860,000 gpd. Peaks are due to industrial load. Chart 2, after metering 24-hour flow was 382,000 gpd.

ing of $\frac{1}{2}\%$ interest on the existing bonds resulted in a net saving sufficient to pay for the meter installation.

There were many problems of installation that are generally common to all metering programs and therefore not discussed in this article. The best bid price obtained for installation was \$28 for a $\frac{5}{8} \times \frac{3}{4}$ meter. It was decided to make the installation by force account, using our existing personnel. This was anticipated to be slower, but resulted in actual installation cost of \$21.74 for this size meter. This netted a saving of \$5,972.04. For those who may be interested, the accompanying table shows the breakdown of this cost.

Resentment by the public to the installation of meters is a natural reaction. The best antidote to this resentment is probably unknown at present. The course pursued here was that of working with those who showed unduly large consumptions. One incident recalled is that of a dairy. This dairy was receiving water under a flat rate at \$5 per month. The first month under a meter showed a consumption of approximately 600,000 gallons. By working with this dairy, the consumption was reduced to approximately 250,000 gallons per month. Another incident is that of a ladies' beauty shop. Initially this establishment showed a

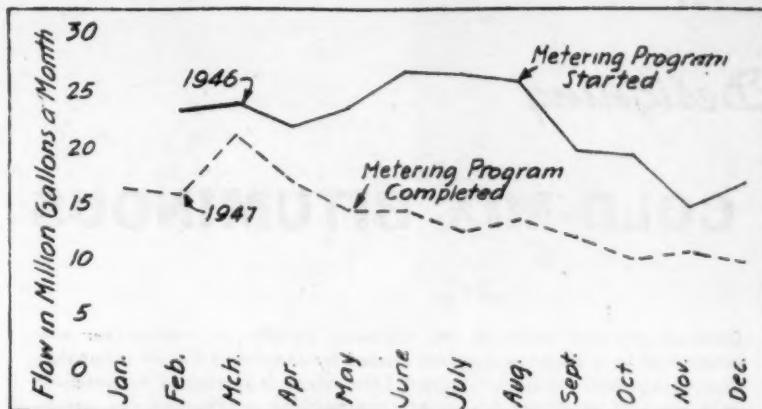


Fig. 2. Chart of master meter monthly flow showing results of metering program in reduction of water use. See also Chart 1, Fig. 1.

consumption of 177,000 gallons per month. Now it is regularly using approximately 13,000 gallons per month.

The first reaction of the consumer is generally a question of meter accuracy. Often times an immediate test of the meter was necessary to gain cooperation in finding and correcting leaks. Leaks were not found to be 100 per cent the cause of high consumption. Wasteful habits contributed largely in some commercial establishments. Individual study of these

were required. Recommendations were made. This was necessarily slow but resulted in reduction of initial consumption in practically all instances and almost 100 per cent in consumer understanding and satisfaction. Sometimes complete consumer satisfaction can be gained by going to what may seem to be extreme. Although all meters were new and had been in service but a few months, there were instances where the consumer was encouraged to go into the meter shop and select from the new meter stock a meter of his own choice. This meter was then tested in his presence and used to replace his existing meter, again in his presence. In certain aggravated cases this was used with good results. In less than a year and a half our water account complaints have dwindled to a smaller per cent than our electric accounts, which were metered long before the experience of the writer. Patience and perseverance is certainly a valuable attribute to anyone during this initial period of metering.

The net results of the metering program can be observed from Figs. 1 and 2. Observation of Chart 2, Fig. 1, shows that off-peak demands have been reduced to a very low flow. Also Fig. 2 shows the monthly master meter flow before and after complete metering. It will be noted that consumption has been reduced approximately 50%. Power cost for pumping has been reduced approximately 25% in dollars and cents. This results in a net saving of about \$100 per month. Average increase in gross revenue is approximately 45%. In addition to meeting current expenses, providing for a Renewal and Replacement Fund, and a Bond Fund, the system now shows a substantial monthly return to surplus. This may be observed from the table herewith.

AVERAGE COST BREAKDOWN FOR INSTALLING METERS

Size Ins.	Number	Cost Each	Materials	Labor	Eng. & Supv.	Trans.	Total
$\frac{1}{2} \times \frac{3}{4}$	954	\$11.00	\$5.87	\$3.05	\$1.49	\$0.33	\$21.74
$\frac{3}{4}$	1	18.90	6.10	3.40	1.48	.35	30.23
1	6	25.41	7.00	3.67	1.57	.35	38.00
1½	4	46.20	14.41	7.50	3.07	.38	71.56
2 (compound)	6	89.10	26.45	24.16	10.70	.43	150.84
3 (turbine)	1	132.60	63.60	18.00	8.00	2.00	224.20
Average		11.85	6.09	3.22	1.56	.33	23.06

BEFORE AND AFTER INCOME AND OUTGO STATEMENT

Item	May, 1946	Sept., 1947
Water Sales	\$1,817.48	\$3,153.39
Other Revenue	95.18	47.05
Total Revenue	\$1,912.66	\$3,200.44
Operating Expense	\$1,502.58	\$1,842.90
Depreciation	273.35*	273.35*
Bond Interest	210.00	241.67
Bond Principal	250.00	333.33
Total Expense	\$2,235.93	\$2,691.25
Balance	(\$323.27)**	\$509.19

* Before meters were installed, this amount was not transferred.

** Deficit.

Designing

COLD-MIX BITUMINOUS PAVEMENTS

Data of unusual value to the highway builder or maintainer are presented in a 24-page booklet issued by the Foote Co. in a catalog describing their "Kinetic" mixer. This mixer is designed to produce cold asphalt mixtures for small construction work and for maintenance. Its capacity is about 25 tons per day. This article is based on the information in this booklet and is published with the permission of the Foote Co.

The normal crew for operation of this small plant consists of 6 men—4 laborers, the mixer operator and the spreader raker. With such a crew, a batch weighing 200 lbs. is the maximum for continuous work with wheelbarrows. In proportioning aggregates, shovel capacity may be assumed to be 20 lbs., but should always be checked carefully on the job. Also, it may be assumed for estimating purposes that 100 lbs. of paving mixture will be required for each square yard of pavement 1" thick. Good aggregates should be used, and materials should be so spotted at the site of the job as to permit quick, easy and efficient handling.

VISCOSITY of the asphaltic material is a primary consideration in cold mixes because it controls the amount of asphalt that can be used with any given aggregate. This amount increases as the viscosity increases. Rapid-curing (RC), medium-curing (MC) and slow-curing (SC) asphalts are used. These are available in several grades. The heavier grades can be modified by adding more cutback (kerosene or gasoline), but it is far better to have the proper grade of asphalt available in the first place for the aggregate used and the work to be done. Absorptive aggregates tend to absorb the lighter solvent constituents of a cut-back. In hot weather, higher viscosity materials can and often should be used. Also, the proportion of material passing the #200 sieve influences the viscosity that is desirable. When only a small amount of #200 material is present, a lower viscosity asphalt may be used.

For the mixes described in this article, the aggregate gradings shown in Table I may be used.

Designing the Mix

In the booklet, seven basic specifications for mixes are given, not all of which will be listed here. These mix specifications are all based on a 200-lb. batch, and show the amounts of the various aggregates and the range of asphalt content that may be

required. Within these ranges, the precise amount of asphalt (and sometimes of mineral filler) must be determined for each particular combination of aggregates and asphalt material. This may be done by preparing a number of trial mixtures. Since no physical tests are in general use, careful visual inspection must

be combined with good judgment. Trial mixtures may be made with small quantities in the laboratory, or with full size mixes. Examination should be made to see that all aggregate particles are thoroughly coated. The trial mix may further be tested by compaction in a cylinder to determine if an excess of asphalt appears at the surface; if the surface is easily indented by pressure, indicating too much asphalt; or if the compacted mass is dry and crumbly, indicating a deficiency of asphalt. A modification of the swell test may also be employed, submerging a cylinder of the material in water and determining the amount of its expansion after several hours soaking.

The gradation of the aggregate should, of course, be known. When this is the case, the approximate amount of liquid asphaltic material to be used can be determined by the formula:

$P = 0.035A + 0.0975B + 0.141C$
where P is the total per cent by

	COARSE			FINE		FILLER
KM-A Number	1	2	3	4	5	6
Aggregate producers simplified practice numbers	#6	#8	#9			
Other specified designations		—	—	ASTM C33-46	From Asphalt Institute Specifications	
				Concrete sand	Sheet asphalt sand	Mineral filler
Total passing 1"	100					
Total passing ¾"	90-100					
Total passing ½"	20-55	100				
Total passing ¾"	0-15	85-100	100	100		
Total passing #4	0-5	10-30	85-100	95-100		
Total passing #8		0-10	10-40		100	
Total passing #10		0-8	15-30	65-90	98-100	
Total passing #20			0-5	30-70	80-95	
Total passing #40				15-40	55-80	98-100
Total passing #80				0-15	20-40	88-100
Total passing #200					0-5	65-100

Table I. Aggregate gradings used in the examples worked out in this text. KM-A Numbers refer to the aggregate sizes used in the specifications given in the booklet.

weight of liquid asphaltic material based on the weight of the total aggregate combination; A is the per cent by weight of the aggregate retained on the #10 sieve; B is the per cent by weight of the aggregate passing a #10 sieve and retained on a #200 sieve; and C is the per cent by weight of the aggregate passing the #200 sieve.

Chemical Additives

Some aggregates, especially when used in dense graded mixtures, are affected by moisture. Recently, chemicals have been developed to combat this preference by some aggregates for water. Among these chemicals are Kotal, No-Strip, Permacote, Kling and Aggre-Coat. These may be admixed with the asphalt, or used directly in the mixer during mixing. In cold weather, their use is sometimes essential when aggregates and construction are exposed to unfavorable weather. Such chemicals may make satisfactory mixes possible in spite of moisture that may be present in the aggregates. Preference among these chemicals may depend on the characteristics of the aggregates. In general, chemical additives should be used where moisture conditions are adverse. The editor will assist in obtaining data on these, if our readers will write him.

Dense Graded Aggregate Mix

A mix formula for coarse, medium and fine aggregate, combined with a cut-back asphalt, is shown in Foote Specification KM-3. This is intended to be laid on a prepared base and compacted to a thickness between $1\frac{1}{2}$ " and 3". It consists of 67 lbs. each of aggregate Nos. 1, 3 and 5 of Table 1; 2 to 4 quarts of aggregate No. 6; and $1\frac{1}{2}$ to 2 gals. of cut back, using RC-2 or MC-2 in cool weather and RC-3 or MC-3 in hot weather.

A specification for dense graded aggregate base course, designated as KM-4 by the Foote Co., consists of 80 lbs. of aggregate No. 1; 60

lbs. each of aggregates 3 and 5; up to 2 quarts of aggregate 6; and $1\frac{1}{4}$ to $1\frac{3}{4}$ gals. of asphaltic material. For the corresponding surface course, the mix consists of 90 lbs. of aggregate #3; 70 lbs. of aggregate #4; 40 lbs. of aggregate #5; 1 to 4 quarts of aggregate #6; and $1\frac{1}{2}$ to $2\frac{1}{4}$ gals. of asphalt. RC-2 or MC-2 may be used in cool weather; and RC-2 or 3 or MC-3 in hot weather. Emulsified asphalt may be used, SS-1, $1\frac{3}{4}$ to 3 gals. for the base course and 2 to $3\frac{1}{4}$ gals. for the surface course.

Patching Mixtures

A patching mix of open textured type is covered by Foote Specification KM-6, Mix B, for patches over $1\frac{1}{2}$ " deep, is composed of 200 lbs. of aggregate #1 and $\frac{3}{4}$ to $1\frac{1}{4}$ gals. of RC-1 or RC-2, or 1 to 2 gals. of Emulsion MS-3. Mix A, for patches less than $1\frac{1}{2}$ " deep, is composed of 110 lbs. of aggregate #1; 90 lbs. of aggregate #2; and the same amounts of asphalt as for Mix B.

A general utility mix for patching holes, filling depressions, and replacing or repairing surfaces is covered by Foote Specification KM-7. This calls for equal amounts (66 $\frac{2}{3}$ lbs.) of aggregates #1, #3 and #5; 2 to 4 quarts of aggregate #6; and $1\frac{1}{4}$ to 2 gals. of RC-2, MC-2 or SC-2 in cool weather, or MC-3 or SC-3 in warm weather.

All of these proportions are based on a finished mix of 200 lbs. of aggregate plus the required amount of asphaltic material. Larger or small amounts will require corresponding adjustments in the individual items. Aggregate numbers refer to the numbers in Table 1.

How to Estimate

Example.—It is desired to pave an area $112\frac{1}{2}$ ft. by 24 ft. with a 3" asphaltic concrete surface, using the surface course mix of Specification KM-4. To determine the amount of material needed, it will be assumed that 100 lbs. of material will be required per sq. yd. for each 1" of depth. The area is $112\frac{1}{2} \times 24$ or 2,700 sq. ft. or 300 sq. yds. The total amount of mix required will be $300 \times 100 \times 3$ or 90,000 lbs. To determine the proportion of the aggregates, it will be assumed that the specific gravity of aggregate #6, the mineral filler, is 2.65, and that 2 quarts are used for a 200-lb. batch. Then the total weight of the aggregate is 211 lbs., of which aggregate #3 amounts to 90 lbs., or 42.6%; aggregate #4 is 70 lbs., or 33.2%; aggregate #5 is 40 lbs., or 19.0%;



This impactor is most helpful in compacting small paving jobs.

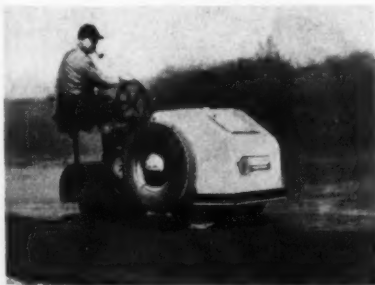
and aggregate #6 is 11 lbs., or 5.2%.

Reference is now made to Table 1 to determine how much asphalt will be needed on the basis of aggregates retained on No. 10 sieve, etc. By taking the midpoints of the percentages of aggregates passing the various sieves, it will be noted that $77\frac{1}{2}\%$ of aggregate #3 is retained on a #10 sieve and the remaining $22\frac{1}{2}\%$ does not pass the #200 sieve. With aggregate #4, $22\frac{1}{2}\%$ is retained on the #10, and the remaining $77\frac{1}{2}\%$ is all retained on the #200. Similarly with aggregate #5, 1% is retained on the #10, $96\frac{1}{2}\%$ on the #200, while $2\frac{1}{2}\%$ passes the #200. All of aggregate #6 passes the #10, $17\frac{1}{2}\%$ is retained on the #200 and $82\frac{1}{2}\%$ passes #200. Multiplying these percentages by 42.6%, 33.2%, 19.0% and 5.2% respectively, it will be found that 40.7% of the combined aggregates are retained on the #10; 54.5% pass the #10 but are retained on the #200; and 4.8% pass #200. These proportions can now be inserted in the asphalt content formula to determine the approximate amount of asphalt required.

$$P = (0.035 \times 40.7) + (0.0975 \times 54.5) + (0.141 \times 4.8) = 1.43 + 5.31 + 0.68 = 7.42\%$$

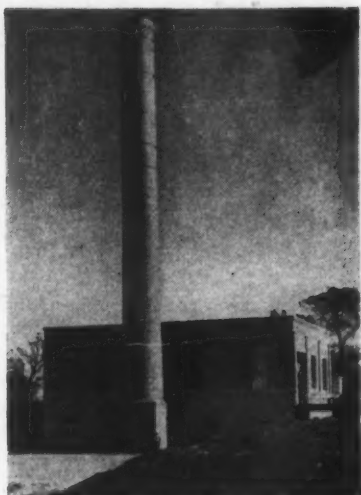
This is equivalent to 1.9 gallons for the 200-lb. batch of specification KM-4.

Since the asphalt comprises 7.42% of the batch, the aggregate will comprise 92.58%. Asphalt required will be $90,000 \times 0.0742$ or 6,678 lbs. or about 725 gallons. There will be required $90,000 \times 0.426 \times 0.926$ or 35,500 lbs. of aggregate #3; $90,000 \times 0.332 \times 0.926$ or 27,660 lbs. of aggregate #4; $90,000 \times 0.190 \times 0.926$ or 15,830 lbs. of aggregate #5; and $90,000 \times 0.052 \times 0.926$ or 4,330 lbs. of aggregate #6. The aggregate totals 83,320 lbs. and the asphalt 6,678 lbs.



Courtesy Littleford

A highly mobile roller for use on the kind of jobs described in this article.



Memphis Chamber of Commerce
Memphis garbage incinerator.

DURING the summer of 1947, the Tennessee State Planning Commission undertook to survey the charges levied in the cities and towns of the state for water, sewer and garbage collection services. The study, which was initiated at the request of a number of municipal officials, was of particular interest to these officials who, because of the increasingly high cost of municipal government, were faced with the problem of increasing charges for these services in their own communities, or of instituting such charges for the first time in an attempt to place the services on a self-sustaining basis.

The data gathered on garbage collection practices and charges made for this service, as well as supplementary information on methods of garbage and refuse disposal currently employed in Tennessee, should be of interest to public officials in other states, since our survey was one of the few such studies to have been made on a state-wide basis.

Making the Study

Information for the study was developed by means of a mailed questionnaire supplemented by additional correspondence and personal visits. The survey had the active support of the Tennessee Municipal League, the Tennessee State Health Department, and the Tennessee Taxpayers Association, and to these agencies is due much of the credit for the completeness of the study. Information was received from 115 communities of the state, including, with a few exceptions, all municipalities of over 3,000 population, as well as a representative group of the very smallest towns. The information ob-

Garbage Collection Practices In Tennessee

CHARLES L. CRANGLE

State Planning Technician, Tennessee State Planning Commission

tained from the questionnaire was tabulated according to population groupings (under 1,000; 1,000-3,000; 3,000-5,000; 5,000-10,000; 10,000-35,000; over 35,000) because municipal officials were interested primarily in practices in communities comparable to their own in size.

The survey indicates that garbage and refuse collection is accepted as a municipal responsibility in more than half the communities studied. Of the cities and towns reporting 61% indicated that they collect residential refuse, while 66 percent provide service to business and commercial enterprises.

Charges for Collection

However, while garbage and refuse collection is provided by the municipality in a majority of the communities of any size, separate charges for this service are extremely rare in Tennessee. The survey demonstrates that only seven communities, or less than 6 percent of the number polled, charge householders for garbage and refuse collection, and only eight communities charge business enterprises. Of the seven communities reporting residential charges, four charge \$1 per month; one charges 50¢ per week; one \$2.50

per quarter; and one \$5 per year. Business charges are less comparable than the residential: One community charges \$1 per week; one \$1 per month; and one \$10 per year. Four charge on the basis of the amount of refuse collected; one municipality charges 15¢ per can with a \$4 per month minimum; one charges from \$2.50 to \$10, based on individual contract; and two charge from \$5 to \$15 per quarter, depending on the amount collected.

No community of under 1,000 population makes a charge for garbage collection service, nor does any one of the major cities of the state. The incidence of separate garbage collection charges is highest in the communities of 1,000 to 5,000 population where four such charges are found in 66 communities studied. Two cities with populations between 5,000 and 10,000 charge for both residential and business collection. Jackson is the only city of over 10,000 to charge for this service. The survey demonstrated, therefore, that garbage collection and disposal is still financed primarily from the general property tax in Tennessee in those cases where the service is municipally provided.

The accompanying data show the



Rogers Mfg. Co.
Compacting the garbage before covering at the Davidson County sanitary fill.

number of communities in each population bracket which have assumed responsibility for the collection of garbage and other refuse, and also shows the frequency range of collection. These data indicate that in 39 percent of the communities polled there is no municipal service to householders, while 34 percent do not serve business and commercial enterprises.

Private Collection

It is of course inconceivable that the remaining communities, particularly cities of over 3,000 population, have no garbage and refuse collection. The explanation for the failure of the municipality to provide such service often lies in the private collector or scavenger, who for many years has undertaken this service either gratis or at a small charge. In either case his income is ordinarily derived principally from the sale of hogs fed on the garbage collected. The garbage is rarely cooked before being fed. At least twenty rather sizable communities in the state have their garbage disposed of in this manner.

Some of the private collectors gather trash and other rubbish as well as organic matter; this is particularly true where the customer is required to pay a service charge for collection. In smaller towns, however, the hog feeders ordinarily will not remove non-edible refuse. For this reason a number of towns have "trash clean-ups" once or twice a year, at which time the municipal equipment is employed to haul off the accumulated ashes, tin cans, and other refuse.

Failure to provide municipal garbage and refuse collection is most evident in the smaller communities of the state, particularly those of under 1,000 population, and private collectors are rarely noted in these communities either. Individual disposal

seems to be the rule in these towns. There is, of course, a much better possibility of utilizing individual disposal methods without endangering public health or creating a nuisance in small communities than there would be in the larger cities. Ordinarily there are no municipal ordinances against the keeping of domestic animals within the corporate limits of the smaller municipalities, and the individual householder feeds much of his own garbage to chickens or hogs. Individual incinerators are often employed for combustible rubbish, and dumping on vacant lots or along the roadside is resorted to for other types of waste material.

Problems of the Large Cities

The larger cities of the state have, of course, the greatest problems in disposal of collected garbage and rubbish. The city of Memphis (1940 population, 292,942) has employed incineration for a number of years, and operates two incinerators. A considerable amount of trash, however, is still dumped in low areas along the Mississippi River and leveled by bull dozer. Memphis will probably construct an additional incinerator within the near future.

The city of Nashville has a 100-ton incinerator which is used for the disposal of wet garbage and debris from the main business section. Open dumps have up to the present been employed for the wastes from other areas of the city; however, the city intends to establish its first sanitary land fill this year on an experimental basis. In this regard, Nashville, in common with other large cities, faces the problem of obtaining sufficient land for either land fill or open dumping near enough to the city to make these methods of disposal economic.

Chattanooga also possesses a 100-ton incinerator which it employs for



Rogers Mfg. Co.

The Davidson County, Tenn., sanitary fill covered.

disposing of refuse from the business area. Two smaller 50-ton incinerators are not currently in use, and the city has decided to initiate a sanitary land fill this year. Knoxville employs incineration to dispose of approximately one-third of its refuse, while sanitary land fill is employed for the disposal of the rest. The city of Jackson, the largest city in the state (1940 population, 24,332) to charge for garbage and refuse collection, uses a small incinerator for organic wastes, but places all other refuse on a city-owned dump where the material is burned and then covered.

However, the greater proportion of the municipalities which provide city collection services dispose of garbage and other rubbish by open dumps, and most of the private collectors dispose of unusable materials in the same fashion. The dumps are usually located on leased or municipally-owned land outside the city limits which is not considered valuable for other purposes. Ravines, old river beds, and abandoned rock quarries are popular as dumping sites. The refuse is burned on the dumps in about fifty percent of the cases.

Today, however, many communities of Tennessee are beginning to realize that open dumping cannot be continued indefinitely. Location of dumps at the city limits has been criticized by groups of citizens interested in city beautification, and it has been pointed out that such practices often cut off desirable areas for future expansion and tend to lower property values and the assessed valuation of homes in the immediate neighborhood. As dumping sites near at hand are exhausted, it is becoming necessary to haul the rubbish longer distances, at a resultant increase in

(Continued on page 28)

Municipal Garbage Collection Practices in Tennessee

Population Under 1,000—24 communities polled; 8 provide residential collection, from 3 times weekly to once a month; 9 provide business collections, from daily to once every two weeks.

1,000 to 3,000—44 communities polled; 24 provide residential collection, from 5 times a week to once a month; 26 provide business collection, from daily to once every two weeks.

3,000 to 5,000—20 communities; 17 provide residential collection, from daily to once a month; 19 provide business collections, from twice daily to once weekly.

5,000 to 10,000—15 communities; 12 provide residential collections, from twice weekly to once weekly; 13 provide business collections, from daily to twice weekly.

10,000 to 35,000—8 communities polled; 6 provide residential collections, all weekly; 6 provide business collections, all daily.

Over 35,000—4 communities; all provide residential collections, three times to once weekly; all provide daily business collections.

Condensed from "The Traffic Quarterly" published by the Eno Foundation for Highway Traffic Control.

Air Terminal Ground Traffic Problems

ROBERT RAMSPECK

THERE were more than 4,000,000 airline passengers into and out of New York City last year, and it is estimated there will be 18,750,000 in 1955. Chicago, which had nearly as many airline passengers as did New York last year, expects around 17,730,000 in 1955. Approximately 12,260,000 passengers rode domestic scheduled airlines in 1947, which was twice as many as in 1945 and more than four times as many as in 1940. What the future totals will be can only be estimated. However, it is predicted that Chicago may expect 22,250,000 airlines passengers in and out of the city by 1972.

Almost every airline passenger is carried to and from the airport in a highway vehicle. It is clear that the thousands of people who travel even the comparatively short distances between the large cities and their airports every day complicate traffic on the already overburdened highway systems in and around our cities. But this is not all. Large airports require thousands of employees, from the 7,000 at the Washington National Airport to the 10,000 or 12,000 who will work at Idlewild or similar very large fields. Most of them use automobiles or buses to get to their work.

Then there are the air-cargo activities of the scheduled airlines. These increased 107 per cent in 1947 over the year before. Competent authorities say that air cargo will increase further in volume until it eventually overtakes passenger transport as a major source of revenue. Factors tending to increase the traffic congestion around airports are the recently consummated agreements between air carriers and motor truck operators. These already are placing scores of trucks daily on the city-airport highways in the wide pick-up and delivery service by which the speed of the airplane is added to the nation's distribution scheme. Add to these the scores of mail trucks and the hundreds of cars of sightseers that come to the larger airports every day, and problems that tax the

ingenuity of our best traffic planners present themselves.

These difficulties are not entirely in the future. The problems are already here, and on a large scale. Many of them are pressing hard, and the remainder are sufficiently close to be urgent in a few years.

Ground Transport Facilities

Airlines regard ground transport connections and facilities of great importance to their success. They realize they cannot achieve rapid mass transportation and consequently high load factors with greatest advantage to themselves and the public, unless passengers are assured a more rapid means of transport to and from the terminals. One factor is more or less of their own choosing. Airlines are air carriers only. This stand makes them dependent on surface carriers—principally taxicabs or buses—for transport between city and airport.

Obviously, the more serious problems are in the larger cities, and every city presents an entirely different set of conditions. An airport's location, its distance from the business section, the type of management, the form of jurisdiction—national, state, county, municipal, or even private—proximity of trunk highways, the availability, willingness, and fitness of surface transport operators to provide services, varying laws and regulations governing highway transport—these and other factors give individuality to every airport.

This leads to a mixed situation. For instance, a cab may be hailed anywhere in New York or Chicago for a trip to an airport. Or a plane passenger may go to a central terminal and ride to the airport in a contracted vehicle. Yet in many large cities, travel to and from the airport is limited to contract-transportation by limousine or bus, operating on fixed routes, with intermediate stops before reaching a downtown terminal.

This results in a stream of taxicabs,

private automobiles (and trucks) on the heavily traveled routes leading to airports, and another heavy line of vehicles going away from it. These, added to the cars of thousands of employees, persons bent on non-flying business at airports, and casual visitors, make a formidable traffic problem for highway planners, ground transportation executives, airport management, and the airlines.

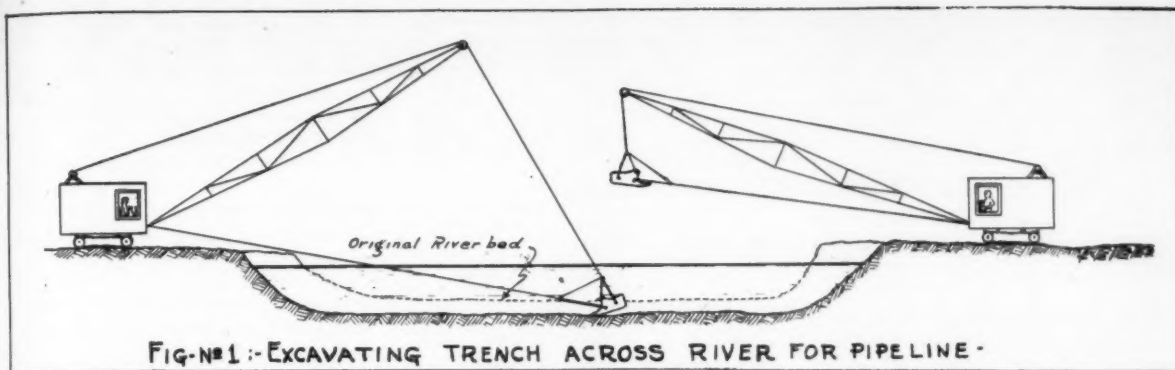
It is estimated that 16 per cent of the total airline passenger traffic of the nation originates in the New York metropolitan area, and a like amount ends there. This should make a total passenger volume of about 4.1 million persons this year, or about 11,500 each day. The Chicago survey shows that an average of about 10,000 persons will arrive or depart from Chicago by air every day this year.

Meeting the To-and-From Problems

In these cities, and others like them, the airlines have, in the main, met their problem of ground transportation connections according to local conditions. At most airports, transportation in limousine or bus is available, under contract with the airlines to provide adequate service. In these cases, full taxicab service is not usually available. That is, when vehicles of a contracting company are available, a cab driver bringing a fare to an airport may find it is made inconvenient for him to find a return fare, no matter how many passengers are de-planing. The contractor feels he has a right to this business, and his vehicles are at the most advantageous locations with solicitous attendants. The cab driver, though he may freely deliver passengers to the airport, finds a virtually closed door when he looks for a fare on the trip back.

A man traveling from New York to Detroit on a hasty schedule, for instance, would be more inclined to choose air travel if he knew that the ground trip from the Forty-second Street airline terminal to Idlewild

(Continued on page 40)



City Saves \$27,250 on Sewer Siphon for River Crossing

MARTIN A. MILLING
Consulting Engineer, Anderson, Indiana

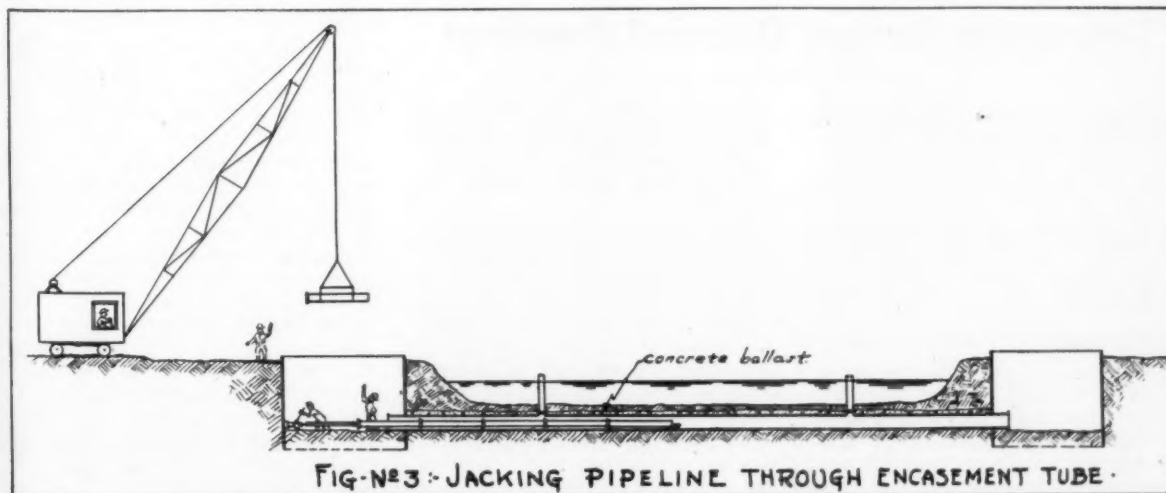
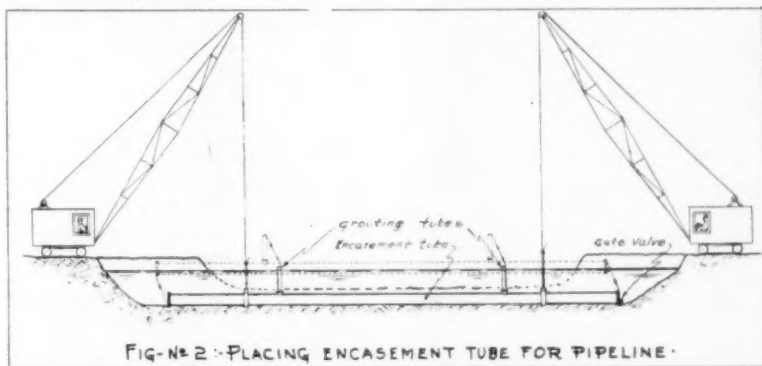
ONE of the projects included in the construction of Anderson's (Ind.) sewer expansion program was an 18" siphon under White River. The river at the crossing site was 110 feet wide, water edge to water edge, and the average depth was about 6 feet.

The specifications required that the 18" pipe be installed 4 feet below the river bed and that it be encased in not less than 4" of reinforced concrete. The main purpose of the concrete encasement was to avoid any possibility of the pipe floating due to buoyancy when and if the pipe were emptied for cleaning purposes. It was also originally specified that the contractor use the conventional method of steel coffer-damming half way across the river at a time and

completing the installation in two operations so as to leave one half of the river channel open at all times.

The lowest bid received under these specifications was \$47,000. This being

above the engineer's estimate, the bids were rejected and the job re-advertised. The plans and specifications were not changed except that the contractors were permitted to use,



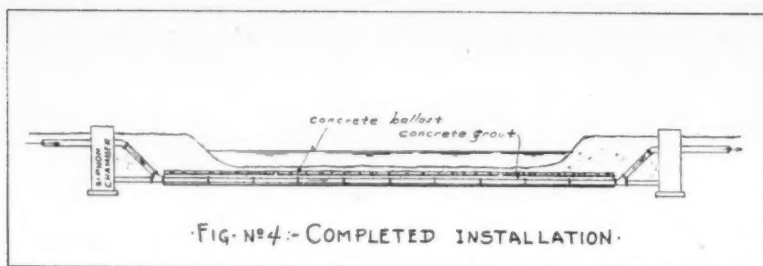


FIG. No. 4.—COMPLETED INSTALLATION.

in place of the steel sheeting, a steel encasement tube long enough to extend all the way across the river through which the 18" pipe could be threaded and then encased in concrete grout. The low bid this time was only \$19,750, which was \$27,250 less than the low bid received for doing the same job by the conventional tight coffer-dam method.

How the Work Was Done

The drawing, Figures No. 1, 2, 3 & 4, show graphically the steps employed in installing the siphon across the river by the "Encasement Tube" method.

Figure 1, shows the methods of excavating the trench across the river bed. Two cranes, one on each side of the river, with drag-line buckets were used in making the excavation. To reach the middle of the river, however, it was necessary to pull the bucket of one crane back across the river with a cable from the other crane.

Figure 2, shows the placing of the encasement tube in the trench across the bottom of the river. The tube was floated on the water surface above the trench previously dug before it was filled with water and sunk. The tube was made out of smoke stack material. It was 31" in diameter; 130' long. Each end was

closed tightly with steel plates, one of which was provided with a 2" valve opening through which the tube could be filled with water and sunk after it had been floated into position over the trench. The encasement tube also had attached to it, several feet from either end, two 8" diameter grouting tubes. These grouting tubes, which extended about 1' above the water surface when the pipe was in place in the trench, were for the purpose of filling the space between the 18" pipe and encasement tube with concrete grout. They also served as vents for the escape of air while the encasement tube was being filled with water and sunk.

Figure 3, shows the 18" pipe being jacked through the encasement tube after coffer-dams had been constructed around each end and the water removed from within the tube.

Figure 4, shows the completed installation. The space between the pipe and encasement tube is shown filled with concrete grout and the grouting tubes removed. The siphon chambers shown at each end are for the purpose of de-watering and cleaning the inverted siphon should the necessity arise.

R. H. Ellis of Alexandria, Indiana, was the contractor and the writer was the consulting engineer for the project.

Tennessee Refuse Disposal Practices

(Continued from page 25)

expense for both manpower and equipment. A number of communities in the state have also been recently alarmed by the increase in the number of cases of murine typhus, which the State Department of Public Health has traced to rats which inhabit open garbage and refuse dumps.

Increased Interest in Disposal

For these reasons, interest in more sanitary methods of garbage and refuse disposal has been increasingly evident in Tennessee since the end of the war. Sanitary land fill has been investigated by a number of

cities and towns, as offering a suitable, and at the same time economic, answer to the problem where suitable areas of land for the project are available.

The experience of Johnson City has undoubtedly encouraged a number of municipalities to initiate this system of disposal. Prior to 1945, Johnson City contracted with a private operator to remove garbage and other wastes from the city, and the edible matter was fed to hogs. After this method was discontinued in favor of sanitary land fill, the city found that the cost for garbage collection and disposal was much less, while at

the same time the new arrangement was far more satisfactory from the public health standpoint. The Johnson City sanitary land fill has served as a demonstration project for a number of communities of the state.

However, while a number of communities in Tennessee are at present planning to initiate the sanitary land fill method of disposal as soon as proper equipment can be obtained, experience indicates that many of these municipalities will need further information and education on the subject if the new projects are to be operated in a proper manner. A number of the so-called "sanitary" land fills currently in operation in the state are far from satisfactory. One reason for this is that the new method has been initiated hastily, and has lacked both proper equipment and supervision. The wastes have been covered, but not satisfactorily compacted, and as a result colonies of rodents infest the fills. In some cases the amount of earth employed to cover the rubbish has been so small that odors have not been cut off, and flies as well as rodents have been able to breed in the debris. Lack of proper location is another criticism of some of the land fills now being operated in Tennessee. Deep gullies have been employed in some instances, and the operators, finding it difficult to cover the outer face of the fill with earth, have contented themselves with covering the top only. In other cases low-lying land along streams subject to flood has been employed without the construction of a retaining wall, resulting in washouts and pollution of the stream. Most of these errors, which have in some instances resulted in criticism of the sanitary land fill by citizens, could have been avoided had a trained operator been employed or had care been taken to have the chosen operator trained prior to the time the land fill was begun.

In conclusion, it can be said that garbage and trash collection financed from the general property tax is prevalent in a little more than half the representative number of Tennessee communities studied, but that desirable methods for the disposal of the collected wastes are rarely found in any but the larger cities of the state, open dumps sufficing in most other cases. Many cities and towns, however, are interested in initiating better methods of disposal, and have turned to sanitary land fill as offering the most economic and satisfactory method of accomplishing this. A real danger exists, however, in that poor methods of administration may discredit many of these land fills and retard new installations.

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Acid Treatment of Wells

GUY PELON, Water Superintendent

Indian Lake Water District No. 2, New York

THE Indian Lake water system went into operation in 1931 and is serving about 800 regular residents plus 4 hotels and 3 cabin sites. The wells and pumping station are located on the bank of the Cedar River, in a very restricted area of about 5,000 sq. ft. Some of the wells are only about 20 feet from the river edge. There are two 4 x 10 Worthington piston type pumps which have a capacity of about 110 gpm. Water is pumped about 2½ miles through an 8" main to a 150,000 gallon storage tank. The lift from the pump house floor to the storage tank floor is 286 feet.

The wells are the gravel packed type approximately 22 feet in depth, with 6' x 6" bronze screens. Originally there were 6 of these wells, but several years ago one was abandoned because of its very low yield. The pumping rate is greatly affected by the river level.

The real gremlin in our water supply is carbon dioxide, which is very corrosive. Before Calgon treatment was started, carbon dioxide gas attacked the original brass cylinder liners of the pumps, and it was necessary to replace them when they were only about 4 years old. Monel was used and showed only .011 inch wear in the following 12 years. Originally the treatment for corrosion was soda ash, but calgon has been used for the past 8 years with excellent results and all complaints of red water have been completely eliminated. It is fed at the rate of about 1 lb. per 20,000 gallons of water by a Proportioners Heavy Duty Midget Chloro-Feeder which has given constant trouble free operation.

Charts and operation records show that over a period of 12 years the pumping rate had gradually declined from 140,000 gpd. in 1935 to about 80,000 gpd. in 1947 and the pump vacuum had increased to 23' by 1947.

It was decided in 1947 to install 2 more gravel packed wells and attempt a treatment of the 5 existing wells. A contract was given to Hall & Company of Delmar, N. Y., and work was started Aug. 1st under the direction of Barker and Wheeler, Albany, N. Y. The new wells, No. 7 and No. 8, are approximately 22 feet

deep and the screens are 50 slot Everdur, 6 feet long and 6 inches in diameter. On a pumping test No. 7 yielded 35gpm., No. 8 yielded 30 gpm. The estimated safe yield for the 2 wells, under working conditions, is considered to be about 50 gpm. These new wells were hooked into the suction header and the rate immediately went up from 80,000 gpd. to 138,000 gpd. Now, everything was in readiness to try the acid treatment.

The top on No. 5 well was broken and acid treatment started using 20° 35% commercial hydrochloric acid. A solution tube of 1" iron pipe with ¼" holes spaced about 6" apart for a height of 6 feet was lowered to the bottom of the screen to make sure the acid reached the bottom of the well; 500 lbs. of acid was then poured into the solution tube and left 12 hours. Then the problem arose—what to do with the acid as it was pumped out of the well. It just couldn't be pumped out on the ground, because it might affect the entire well area, and it couldn't be discharged into the river because the local Game Warden had objections; the river contained trout; no one knew what the discharge of 500 lbs. of acid all at once might do to the fish. It was decided to use lime to neutralize the acid. Dynamite was used to blast two pits about 10 feet across and 6 feet deep. These pits were close enough together so that water could run easily from one to the other, and were about 10 feet from the river edge. The purpose of the two pits was to give more storage space so that 2 wells might be treated at one time. About 150 lbs. of lime was put into the pits and pumping from No. 5 well was started. Lit-

mus paper was used to check the acidity of the water. It was believed that after the acid water came in contact with the lime it was safe for the water to seep into the river. Water at the river edge showed no sign of acid, and no dead fish were found at any time during the treatment of the wells. The remaining 4 wells were treated in the same manner except that only 250 lbs. of acid was used, since it was decided that 500 lbs. of acid might be too strong for a 6 foot by 6 inch screen. About 100 lbs. of lime was used for neutralizing each well following the lighter dose.

The top of each well was replaced with a steel cap containing a new vent pipe, a new drop pipe for suction, and a solution pipe for future treatment of the wells from the ground surface, with hypochlorite acid, or other solutions that might be used to keep the screens clean.

After all 5 wells were acid treated and reconnected to the suction header, the rate in gallons per day went up to 180,000, then tapered off to 160,000 with about a 10-foot draw down at normal river level. There has been no evidence of exhaustion, even after 12 or 15 hours steady pumping.

The yield of No. 5 well before treatment was 12 gpm., as compared to an original yield of 35 gpm. and a yield after treatment of 32 gpm. No. 1 well was increased from 10 gpm. to 20 gpm.; No. 2 from 5 gpm. to 23 gpm.; No. 4 from 10 gpm. to 18 gpm.; and No. 6 from 15 gpm. to 25 gpm.

This article, with slight changes, is from the New York State Health Department's *Water Works News*.

Houston Modernizes Street Equipment

In its program of equipment modernization and street building and maintenance program, Houston, Texas, has recently purchased new and modern street building equipment. Shown herewith is a recent order which includes 10 Galion heavy duty motor graders, Galion heavy rollers and 2 Galion variable weight portable rollers.



Some of the modern road equipment purchased by Houston.



The author at work in the laboratory.

FACILITIES for extensive sewage research in the Department of Civil Engineering of the University of Florida are now being completed. The research work is being undertaken as a cooperative program between the Florida State Board of Health, of which David B. Lee is Chief Sanitary Engineer, and the Engineering and Industrial Experiment Station of the University. For the most part, the individual projects are entered upon at the request of the Research Committee of the Florida State Works Association.

One of the objectives of the research program may be broadly stated to be a practical study of sewage treatment methods adapted to the needs of the smaller Florida community. Florida materials are being utilized as far as practicable. Cognizance is being taken of certain somewhat distinctive Florida conditions, among which are the following:

1. A generally flat terrain, resulting in minimum grades and velocities in sewers. This emphasizes the importance of shallow depth filters and low head-loss distribution.
2. The scarcity of stone normally considered suitable for filter material, making it desirable to investigate the feasibility of using various sands found throughout the State, and of substituting materials such as wood and limerock for the more durable types of aggregates commonly used in trickling filters.
3. The fact that the natural drainage over areas of the State is vertical rather than horizontal, and that ground waters provide the principal source of water supply for the State, makes it necessary to study the economics of high-purity effluents.
4. Seasonal and mean annual temperatures and seasonal distribution of precipitation, necessitate modifications in standard procedures devel-

University of Florida

Sewage Treatment Research

JOHN E. KIKER, JR.

Associate Professor of Public Health Engineering

oped for the most part in northern states.

5. Seasonal fluctuations in population, with corresponding changes in the quantities of sewage to be treated, dictate that sewage treatment plants be flexible to suit varying conditions.

Sanitary Research Laboratory

The scope of the research program is best indicated by a brief description of the facilities. The treatment plant at the Sanitary Research Laboratory is auxiliary to a main campus plant recently placed in operation. Both plants are available for research studies. Facilities at the research laboratory consists of 32 mutually independent units of pilot plant dimensions. The methods of treatment may be varied and the materials may be changed at will. The units of this treatment plant may be briefly classified as follows:

1. Pumping station and calibrated measuring tank for distribution and control of influent.
2. Two types of primary treatment tanks, each designed for 30,000 gallons per day, for comparative studies.
3. Eight intermittent sand filters for parallel comparisons of filter

sands of different quality, size and depth, and at varying operating rates.

4. Six 8-ft. deep trickling filters for similar comparisons of filter media and rates of operation. The filters are equipped with devices for sampling at depth intervals of two feet.

5. Individual secondary settling tanks for each trickling filter.
6. Two sludge digesters for comparative studies.
7. Sludge drying beds.
8. Final chlorine contact tank.
9. Completely equipped laboratory.

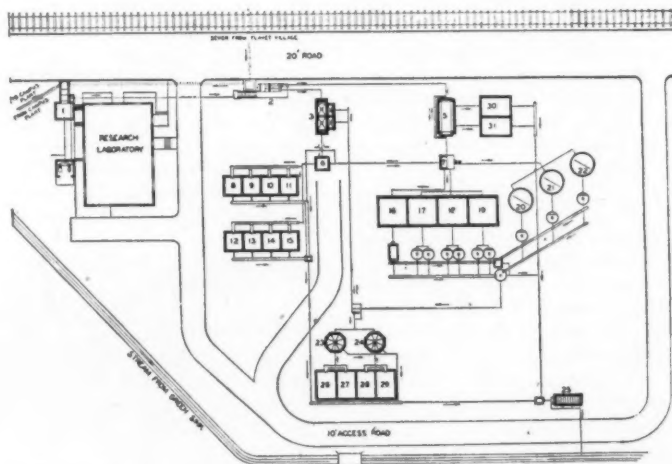
Main Campus Plant

The Campus sewage treatment plant contains the following treatment unit:

Three primary clarifiers with mechanical sludge collectors designed for capacities of 100,000, 200,000 and 400,000 gallons per day at 2 hours detention.

Two 30-ft. diameter sludge digesters, one covered and one open, equipped with heat exchange unit, supernatant selector, and gas collection and metering equipment.

Standard-rate trickling filter, with rotary distributor, designed to treat



General layout of experimental plant. This is the area shown in the upper right corner of the aerial view on the opposite page.

350,000 gallons per day. Settled sewage may be taken from any primary clarifier or the sewage may be recirculated from any point.

High rate trickling filter, with rotary distributor, designed to treat 350,000 gallons per day. Constant-rate flow may be obtained by recirculation with pumps located at the filter unit, or recirculation may be accomplished through other units.

Secondary clarifiers providing for 100,000, 200,000 and 400,000 gallons per day with $2\frac{1}{4}$ hours detention. Effluent may be passed to either filter or to the chlorine wet well.

Control house containing sewage and sludge pumps, chlorine equipment, automatic sewage samplers, recording meter, lecture room for sewage plant operators and students, and a modern laboratory.

Chlorine contact chamber with facilities for controlling the contact period.

Sludge drying beds.

Sampling facilities are provided at various levels of the filter units, and flow meters are provided at all critical points.

The research program involves routine operation of all units of both plants under standard conditions and under such other conditions as may be suggested in order to obtain data which will be useful to municipalities, consulting engineers, the engineers of the State Board of Health, and others. A more complete analytical control is possible over these operations than is usual or possible at most municipal plants. The policy of "testing to failure" may be adopted when desirable at the auxiliary plant, and all operating conditions are under control.

Research Projects

The following research projects are now under way and are indicative of the planned program:

Sand filtration of primary effluent. Sands of varying effective sizes, uniformity coefficients, and depths are being loaded at controlled rates. The rates are changed from time to time and complete analytical data maintained. It is hoped that economic relations of loading, sand size and depth of beds will be established.

Trickling filter materials. Trickling filters are loaded with slag, Florida gravel, lumber mill waste, and Florida Brooksville limestone. Analytical data are kept for each filter to determine the permanence and the relative merits of these materials.

Trickling filter loading rates. An investigation is being made of the performance of a 40-ft. diameter



The University plant is in the foreground; the experimental plant at the upper right is also shown in the plan on the opposite page.

trickling filter at rates of operation between the so-called standard rates and those commonly employed in "high rate" filters. Samples are taken at various depths and the rate of oxidation of organic matter in the sewage is being studied as a depth function. The investigation is expected to furnish the data now missing between standard and high rate filters, to the end of developing a mathematical relationship between loadings and filter performances.

Chlorination of sewage. A sponsored research fellowship in sewage disinfection was prosecuted for about one year. It involved a fundamental study of the reactions of chlorine with organic matters found in sewage. Specifically, it dealt with the reactions between chlorine and glycine, one of the simplest of the amino acids. The reactions with tryptophane are being studied at the present time. Continuation of the project will deal with other amino acids, all of which are characteristic by-products of protein decomposition.

Disinfection of sewage. A study is being made of various disinfectants and an investigation is under way to determine the influence of different physical factors upon the speeds of bactericidal reactions and disinfection efficiencies in sewage.

Personnel. Earle B. Phelps, Professor of Sanitary Science and Professor Emeritus (retired), Columbia University, is serving as consultant on all of the above projects. George R. Grantham, Assistant Professor of

Sanitary Engineering, is project leader on the first three projects and the writer is presently leader on the last two. Professor Grantham is assisted by C. H. Edwards, Chief Chemist at the Sanitary Research Laboratory. The writer is assisted by Wilson T. Calaway, Instructor in Sanitary Science, and Donald Gold, graduate assistant.

Acknowledgments. Dean Joseph Weil is Dean of the College of Engineering and Dr. R. A. Morgen is Director of the Engineering and Industrial Experiment Station. The layout and design of the research facilities are the result of joint efforts by C. D. Williams, Head Professor of Civil Engineering; David L. Emerson, formerly Assistant Professor of Sanitary Science; David B. Lee, Chief Sanitary Engineer of the State of Florida; Charles Richheimer, of Reynolds, Smith & Hills. Engineers; and by Professor Phelps. The campus plant was built by the Paul Smith Construction Company of Tampa, and the auxiliary plant was built with day labor employed by the University.

Equipment for the treatment plants was purchased from the following manufacturers:

Wallace & Tiernan Company—Chlorinators.

Pacific Flush Tank Company—supernatant selectors, gauges, waste gas burner, floating digester covers, gas system controls, sludge heater, heat exchange, and sludge samplers.

(Continued on page 34)

ROADS AND AMENITIES

BRIAN M. ROBERTS, A.M.I.C.E.

A paper awarded first place in a competition on this subject conducted by Contractors Record and Municipal Engineering, an English contemporary. English terms, forms and spelling are used herein.

THE object of this article is to emphasise the importance of amenity as it affects the planning of roads outside urban areas. In order to simplify the problems involved questions of technical or economic importance are ignored, although, of course, in practice they are likely to outweigh considerations of amenity, and therefore must continually be borne in mind.

Considerations affecting the amenity of roads fall under four headings:

- (1) The location of the road in relation to natural features and existing amenities.
- (2) The alignment of the road.
- (3) The layout and construction of the road components themselves, i.e., carriageways, kerbs, footways, verges, etc.
- (4) The design and siting of road ancillaries, such as petrol stations, transport cafés, bus shelters, sign posts, bollards, etc.

Location

The broad principle of road location in relation to amenity is that the road should not destroy existing features, but rather that it should reveal new features and open fresh vistas to the traveller's eye. To quote Ministry of Transport Memorandum No. 575, "the beauty and interest of the countryside depend largely upon the preservation of ancient cottages and picturesque wayside buildings," and new roads should be located in such a manner, not only to preserve them, but also to display them to the best advantage.

The preservation of existing trees, is of a suitable type and reasonable expectation of life, is frequently worth while, though it should not be forgotten that trees may sometimes form a screen hiding something more pleasing than themselves. Water courses can lend themselves to interesting treatment, and an existing stream preserved in a central reservation makes a pleasant feature in addition to simplifying surface drainage problems.

The effect of existing features can be enhanced in several ways. Sometimes this can be done by employing the technique of "vista closing," that is by aligning a straight length of road on some such features as a church steeple, or tree-crested hill, so that the feature is emphasised or, to adopt a contrary technique, a particularly striking feature can sometimes be shown to its best advantage when suddenly revealed by the curvature of the road—though needless to say, the curvature should not be so sudden that the striking feature proves to be an oncoming vehicle. Many motorists must be familiar with the pleasure felt, when, at the crest of a hill such as Birdlip in Gloucestershire, a panorama is suddenly revealed to them. In such cases if the view had not been concealed by trees or a ridge until the crest was reached, the pleasure would not have been so great.

Roads that are located to run through woodlands or forest can provide interest and pleasure either when the layout allows the trees to overhang and meet to form a cool green tunnel, or when they form an avenue open to the sky. In the former case it is suggested in a paper by Cardell and Howarth read before the Road Engineering Division of the Institution of Civil Engineers, that the road should be curved as otherwise "the patch of bright sky ahead has a disconcerting effect, emphasising the comparative darkness within the wood," and the tunnel effect tends to exaggerate perspective. The advice of an arboriculturist should always be sought when roads are planned to pass through woodlands as some types of trees shed pollens or other substances which render the carriageway slippery, and it may be advisable to identify and remove such trees.

Alignment

It is now generally accepted that, as regards alignment, long lengths of straight road are undesirable, both because the monotony is fatiguing to the motorist, and because the long straight road slashed across the

countryside is unaesthetic in itself. The art of alignment lies in so combining and relating the successive curves and straights (both horizontal and vertical) that the effect of the whole, or rather that part of the whole that can be seen at any one time, is harmonious. The alignment should be harmonious not only in itself, but in its relationship to the ground pattern and profile. Why some combinations of curves and straights are not pleasing to the eye it is difficult to say, but it is so. Moreover the pleasant effect or otherwise of a certain alignment is, to some extent, a matter of individual taste and aesthetic appreciation, which renders difficult the laying down of any rigid principles of good alignment. Certain principles are, however, generally accepted, and these are as follows:—

(1) Sudden changes of line or gradient should be avoided by the use of large radius curves, and the length of such curves should not be unduly short, as otherwise the change will still appear to be sudden.

(2) Curves of markedly different radius give an unpleasant effect when in juxtaposition. The insertion of a short length of straight between them does not improve their appearance, and the best solution is to replace the two curves, if possible, with one curve of suitable radius or progressively varying radius.

(3) Transition curves are "sweeter to the eye" than the straight-forward junction of circular curves with tangents.

(4) The combination of vertical and horizontal curves may give rise to unforeseen effects, unless the final alignment is carefully considered in three dimensions.

(5) Super elevation improves the appearance of a curve, and should always be employed for this reason, quite apart from its more practical advantages.

The foregoing points have been concerned with the harmony of the alignment within itself. In so far as harmony with the ground pattern is concerned, the alignment should, in general, conform to the contours, and sharp contrasts in scale between the alignment and the lines of natural features should be avoided, for example, a straight, or practically

(Continued on page 42)

SEPARATE slugs that in has been twenty engine accepted the first operator are still a new proper of the ators c

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Reducing Heating Maintenance Cost On Sewage Treatment Digesters

V. A. VASEEN

Assistant Engineer, Ripple & Howe, Consulting Engineers, Denver, Colo.

SEPARATE digestion of wastes sludge in a tank removed from that in which the solids are settled has been common practice for some twenty years. However, even today, engineers disagree as to what are accepted design factors and some of the first problems encountered by the operators of the first plants built are still problems for the operator of a newly built plant. For instance, proper heating of the digester is one of the problems still facing the operators of both new and old plants.

Several methods have been used by engineers for heating a digester, but each of these has its own disadvantages. A common, and probably the oldest, method of heating the contents of a digester is the submergence of pipe coils containing hot water or steam into the digesting sludge. Many ways have been devised to do this but most of them still have the same old problems. In order to get a quantitative exchange of heat from the pipe to the sludge, the pipe, due to its relatively small area, must be high in temperature (130°-140° F). This causes scale, sludge, mineral, and other material to deposit or "bake" on the pipe surface and eventually reduces the heat transfer efficiency to the point where the coils have to be cleaned. The high temperature in the vicinity of the pipe may kill by "cooking" many desirable bacteria. There is also the problem of alkaline foaming when cold sludge pockets are too rapidly heated. The greatest problem of heating a digester by this method is the expensive repairs that may be required by the corrosion of pipe coils and their hangers.

Steam or hot water is often used to heat digester contents, these being introduced directly into the digester contents. Here also are the problems of cold and hot sludge pockets, killing of bacteria, and the new problems of added quantities of supernatant liquor and the cost of steam or hot water.

More recent practice is to remove the sludge from the digester, heat it outside the tank in a separate heat exchanger, and then return it to the digester. The efficiency of heating by

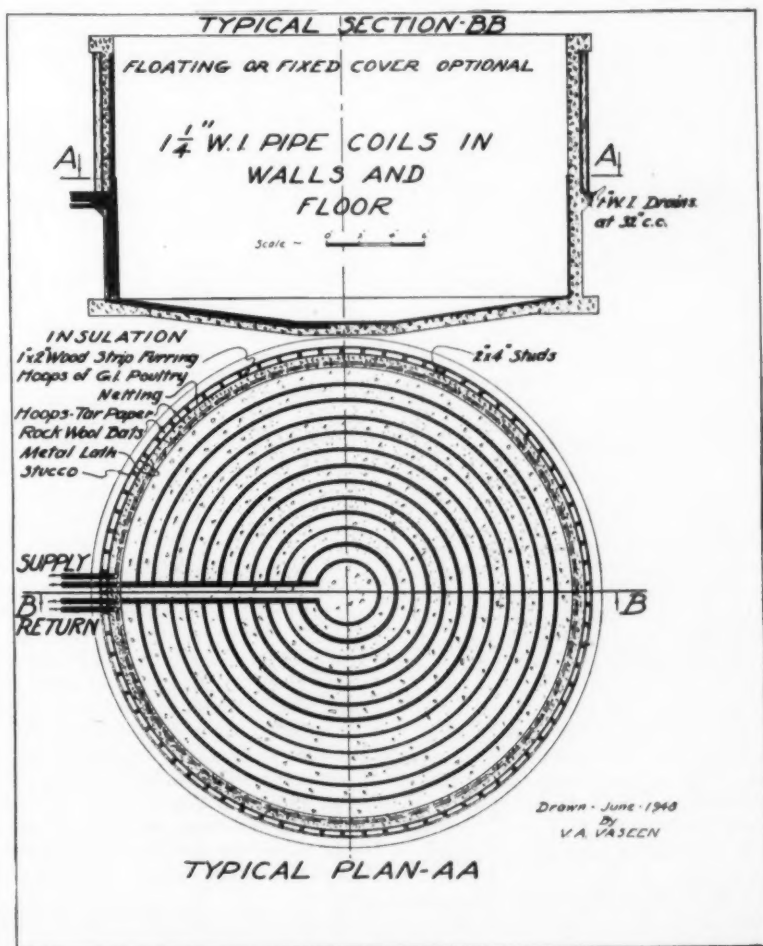
this method is also dependent on the efficiency of sludge turnover and it may also leave cold sludge pockets. Added to this is the problem of continuous pumping costs for recirculating the digester contents one to one and a half times per day.

In all the above mentioned systems there is the problem of cold walls and floors which contribute to undesired settling of chilled sludge along the walls; also chilling of bacteria and consequent reduced efficiency which in turn disturbs the bacterio-

logical and chemical equilibrium of the digester contents.

Wall and Floor Heating

Most recent design indicates that the pipe coils for heating the digester contents should be embedded in the concrete walls and floor of the digester and the walls used as the energy storage. Since the direction of heat loss is then from the walls into the sludge, instead of the other way around, adiabatic sludge digestion conditions can be approached. This is



Method of piping the digester for sludge heating. Pipe spacing and placement data are given in the article.

of special consideration in small diameter digesters: For example, the percentage of sludge within twelve inches of the walls and floor is a considerable proportion of the total in a 10-ft. diameter digester.

Existing structures indicate that between 5.0 and 5.5 BTU per hour per square foot of steel or wrought iron pipe surface per degree F difference in mean water temperature of the circulating heating water and the digesting sludge is a safe design figure in calculating the pipe necessary for heating. The following formula may be used to determine the pipe required:

$$P = HL / 5.5 \times A \times dT$$

where P = linear feet of pipe; HL = total heating load (in all directions from digester walls); A = external pipe surface area per linear foot; and dT = Temperature difference (mean circulation water and sludge temperatures.)

The sketch herewith shows a portion of the plan for the 30-ft. digester for the sewage treatment plant at Leadville, Colo. The $1\frac{1}{4}$ " wrought iron pipes in the walls are spaced 15" on centers and are located $3\frac{1}{2}$ " from center line to the inside surface of the walls. The pipes in the floor are 18" on centers and are located just below the top mat of reinforcing steel.

Incidentally, in this plant, $1\frac{1}{4}$ " pipe coils are placed in the floor to provide heat for the control and storage rooms and the garage. These pipes are spaced 12" on centers. (Ed. Note: The elevation of the top of the digester is 9974 ft. Does anyone know of a higher treatment plant?)

Piping Materials

Many materials could be used for the piping; however, wrought iron, steel, copper and aluminum are the most common. Several factors need to be considered when choosing a material. The piping material must transfer heat with the smallest possible difference in temperature: It must be mechanically strong, and expand at nearly the same rate as surrounding materials: It must be readily bent and welded into a strong, durable unit. Wrought iron or steel is probably the best economical and engineering choice. Horizontal bare black iron or wrought iron $1\frac{1}{4}$ " pipe has, with 120° F. hot water, an emission factor of 0.847 BTU per hour per linear foot per degree temperature difference, where $1\frac{1}{4}$ " copper pipe has but 0.340 BTU. Also per same diameter pipe, wrought iron or steel pipe has more surface area per square foot than copper or aluminum:

Wrought iron, $1\frac{1}{4}$ ", has 0.435 sq. ft. per foot and $1\frac{1}{4}$ " copper or aluminum, 0.360 sq. ft. per foot. Of all these factors the coefficient of expansion often is the critical factor in the choice of pipe. The more closely the coefficient approaches that of concrete (10/1,000,000 length per unit length per degree C, then the more desirable the pipe material. Copper has a coefficient of 14.09/1,000,000 and aluminum 18.35/1,000,000 where wrought iron and steel have a coefficient of 11.40/1,000,000 or very nearly that of concrete and should probably therefore be considered as first choice.

In colder climates where the incoming raw sewage and consequent raw sludge has an average temperature below 60° F. it is probably advisable to pass the raw sludge through a small heat exchanger and bring it up to 90° F. before introducing it to the digester. In this way no extra pumping costs are encountered except for the friction loss through the heat exchanger. This operation also removes any possibility of cold sludge pockets occurring, with their subsequent undesirable effect on the efficiency of operation.

When the pipe coils are designed they should be grouped into several banks and each bank of coils controlled by a gate valve. If this is done the operator can raise or lower the heat input to the top of the tank walls, middle of the tank walls, bottom of the tank walls, or floor. By raising the heat input to the scum blanket wall area, more rapid bacteriological action takes place and heavy greases can be kept in a liquid state which is more conducive to digestion. Also, walls can be cooled and the floor raised in temperature to cause the digester contents to "turn over" in much the same manner as the spring and fall "turn over" of a water reservoir, thus producing a desirable mixing effect.

Maintenance and operation costs are negligible on this type of heating system. Panel-type heating systems are in operation in Europe which have given trouble free operation since World War I. Among them are the Bank of England, London; Banque D'Espagne, Madrid; and Benito Mussolini Tuberculosis Hospital, India. Such systems are in use in twenty-five countries and on three large passenger liners. (Panel Heating and Cooling, Raber and Hutchinson).

Ripple and Howe, Consulting Engineers, Denver, Colorado, have completed the design, plans and specifications for two complete treatment plants, each with a digester heated

in this manner: One at Raton, New Mexico, and one at Leadville, Colorado. It is also reported that the digesters designed for Puyallup, Washington, are to be heated in this manner. (Sewage Works Journal, March, 1948.) Attention is also invited to an article in "Heating, Piping and Air Conditioning," August, 1947, page 94, which describes the operation data for a thickener tank in a chemical plant heated by embedded coils.

Florida Experimental Plant

(Continued from page 31)

Chicago Pump Company—comminutor and water seal unit.

The American Well Works—clarifier conveyors, motors and drives.

Simplex Valve and Meter Company—filter influent flow meters.

R. W. Sparling—flow meters.

Republic Flow Meters Company—other flow meters.

Ayer-McCarel-Reagan Clay Company—filter bottom block.

Infilco, Inc.—rotary distributors, dosing siphon, automatic samplers.

Economy Pumps, Inc.—recirculating pumps.

Ralph B. Carter Company—sludge pumps.

Fairbanks-Morse & Company—sampling pumps.

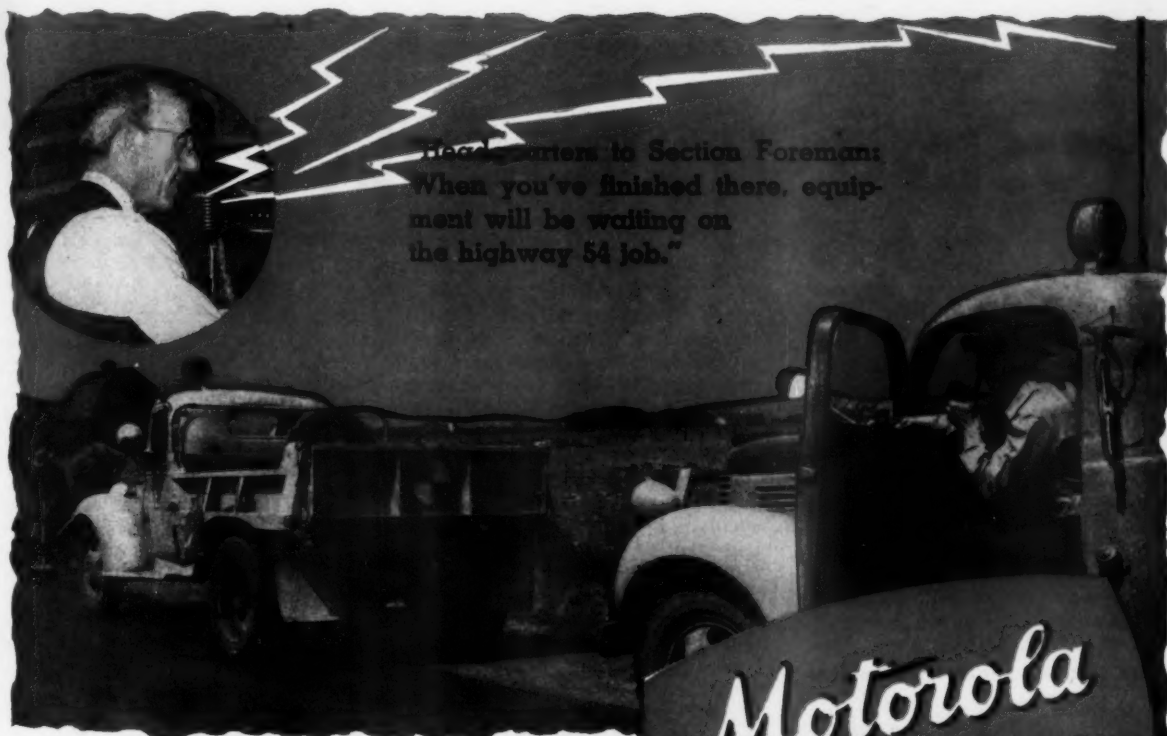
Pittsburgh Equitable Meter Div., Rockwell Mfg. Co.—gas meters.

Lightning Strikes Bridge and Breaks Sewer

A most unusual accident occurred at Sioux Falls, S. D., when lightning struck a steel trestle carrying the main domestic sewer line to the treatment plant. The trestle collapsed and the sewage was discharged into the Big Sioux River, which fortunately was high at the time, affording reasonable dilution. This accident was reported to the S. D. Clarifier, publication of the Sanitary Engineering Division, of which W. W. Towne is chief engineer.

Bid Prices for Water Mains

Bid prices for laying water pipes at Camp Hood, Texas, were received Aug. 6, 1948. For 6,100 ft. of 8" water pipe, complete, in place, bid prices by the 3 contractors bidding were: \$2.44, \$2.50 and \$4.77 per ft. For 885 ft. of 6", bids were \$2.20, \$2.26 and \$4.42. For 3,720 ft. of 4", bids were \$2.00, \$2.00 and \$4.13.



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the highway 54 job."

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USING HYPOCHLORITES

HYPOCHLORITES have a wide use in the treatment of small water supplies, in sterilizing wells and water mains, in treating swimming pool waters, and occasionally in small sewage treatment plants. In most of these uses, it is important to have equipment that will apply the solution, and consequently the chlorine, accurately; dependability is essential; and intelligent and well trained operators are required to assure that the required amount of chlorine is applied at all times.

State Sanitary Engineers Comment

"In general," says F. H. Waring, Chief Engineer of the Ohio State Department of Health, "a hypochlorinator should be considered for any quantity of water less than 250,000 gallons per day, and should be used in all cases for 100,000 gpd. or less. Assuming the life of chlorinators to be about equal (to that of hypochlorinators) there is a quantity above which it is more economical to use a vacuum (gas) feed machine. . . . For large swimming pools, more than 100,000 gallons, vacuum type liquid feed chlorinators are generally used. Pools of less than 100,000 gals. can use a hypochlorinator satisfactorily. In the past, manufacturers have complained about the long periods of time that chlorine cylinders have been tied up at small swimming pools and water plants. . . . Where hypochlorinators can be used economically, we favor them from the standpoint of safety. They are also easy to maintain during those periods when they are not in use."

"Hypochlorites find economical application for the disinfection of public water supplies in the smaller communities where the relatively low cost of installation may offset the greater cost of chlorine in the form of liquid chlorine," says Arthur D. Weston, Director of Sanitary Engineering of the Massachusetts Department of Public Health. In Michigan, "it has been our policy to attempt to get liquid chlorine machines in all plants where it is ab-

solutely necessary to have positive and effective chlorination 24 hours a day. At those ground water supplies where we deem chlorination is necessary as a factor of safety because of poor location or poor construction of the well, we permit the use of hypochlorites."—Raymond J. Faust, chief of the Division of Water Supply, Bureau of Engineering, Michigan Department of Health. "Sodium and calcium hypochlorites are used effectively to sterilize wells or small distribution systems. They find effective use also in emergencies where rather high caliber supervision can be given to their use. They are used extensively, but perhaps not too effectively, at small water treatment plants and small swimming pools. . . . It has been our experience here in Indiana that hypochlorinators reach their practical limits on pumps of 100 gpm. capacity. This is not a hard and fast rule, of course. Such factors as chlorine demand of the water and available solution storage may govern. We do not favor use of hypochlorites where solutions for at least 30 hours operation cannot be held in the supply crotch."—George C. Fassnacht, chief of the Water Supply Section, Division of Sanitary Engineering, State Board of Health of Indiana.

"Hypochlorinators are used as the principal chlorine feeders by some

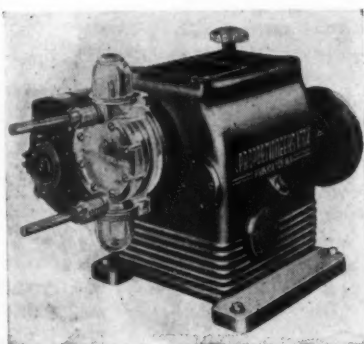
28 public water supplies (in Tennessee) and they provide standby service for 9 other supplies which use gas machines for regular service," says Willis H. Lewis, Principal Engineer, Division of Sanitary Engineering, Tennessee Department of Health.

From these quotations it will be seen that hypochlorinators and hypochlorites perform a most important task in protecting public health in many communities. It will also be seen that there are difficulties connected with their use, and that more effective training must be given operators in order to assure the continuous effective application of chlorine. Says Mr. Fassnacht: "The results obtained are usually in direct proportion to the skill of the operator. . . . Hypochlorites will do the job of disinfection as long as they are properly applied. Failures in the small plants where their use is indicated are practically always due to failure in the process of introducing the chemical."

Before going into further details of the advantages and disadvantages of hypochlorite application—and how to overcome some of the latter—it is desirable to present briefly what is considered good operating practice in hypochlorination.

Good Operating Practice

The following outline of instructions for operators using hypochlorites is adapted from material furnished us by Mr. Lewis of Tennessee. Hypochlorite solutions are made up from calcium hypochlorite powder containing about 70% of available chlorine. The hypochlorite solution is usually stored in an earthen crotch (which is not affected by the chlorine) from which the hypochlorinator draws. The strength of the solution to be used depends on the water pump rate, the chlorine demand of the water to be treated and the capacity of the hypochlorinator. Although it is possible to select the desired strength of solution from tables furnished by some of the manufacturers, this is usually determined by trial and error. Gen-



Proportioners heavy-duty hypochlorite feeder, capacity up to 8 gals. per hr. and against pressures up to 175 lbs. Smaller units are also available.

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erally a solution strength of $\frac{1}{4}\%$ to 1% of chlorine is used. The chlorine content of the solution should be such that the feeder will operate at a medium rate, rather than with a maximum or minimum setting.

Care must be taken if consistent results and a uniform dosage of chlorine are to be obtained. It is helpful to calibrate the crock in inches of depth and have a table prepared showing the number of ounces of hypochlorite to be added to the corresponding inches of depth of water. It is, of course, desirable to prepare the hypochlorite solution in a separate crock, and in advance of need, so that the sludge will have time to settle out. If the average daily use is computed, either by volume or by inches in the crock, the computations for the amount of hypochlorite and water are simplified. Where the water used in making up the solutions is relatively hard, it is advisable to add a little soda ash to aid in clarification.

After the feeder has been started and the suction line is filled with solution, the air should be exhausted from the feeder by opening the bleeder valve on the discharge stroke only. When the feeder is operating properly, and the chlorine solution is being applied to the water being treated, a sample of water should be taken from the main about 25 ft. beyond the point of application of the chlorine. The water should be tested with a comparator, using orthotolidine indicator. If the resid-

ual does not fall between 0.2 ppm and 0.5 ppm; the feeder should be adjusted upward or downward and the residual checked again after a few minutes.

After the feeder is operating and the dosage has been adjusted to give a satisfactory residual, the water should be tested daily for chlorine residual. Solution should be prepared as required, not too far in advance, since some loss of strength occurs over a period of several days. The solution crock should be covered to minimize such loss of strength.

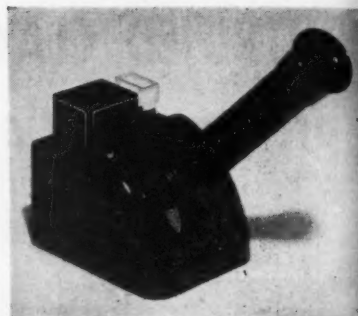
Hypochlorite feeders require very little attention other than routine operation, testing for residual, and preparation of solution. The manufacturer's instruction booklet should be consulted for oiling and routine maintenance. A supply of spare parts, including sight glasses, check valves and diaphragms should be kept on hand. Occasionally it may be necessary to soak the sight glasses, tubing, etc., in an acetic acid solution or in vinegar to remove the lime coating that may form on them.

How to Figure Dosages

A 1% solution contains one part of chlorine in 100 parts of water, or 10,000 parts per million. One pound of 70% (commonly called high-test) hypochlorite in 8 gallons of water gives a 1% solution of chlorine; for larger quantities use 3.75 pounds in 30 gallons of water or 5 pounds in 40 gallons; for smaller quantities use 2 oz. of hypochlorite to 1 gallon of water. With all these solutions, there is 1 pound of chlorine in 100 pounds, or 12 gals. of water.

To determine how much chlorine and chlorine solution is needed, the dosage or amount of chlorine to be applied to the water is used as a base. If the dosage is to be 1.0 ppm. (often a heavier dose will be required), 8.3 pounds of chlorine will be required to treat each 1 million gallons of water, or 0.83 pound or $13\frac{1}{4}$ ounces for 100,000 gallons. Remembering that there is 1 pound of chlorine in 12 gals. of 1% solution, and that 0.83 pound is needed for 100,000 gals., the amount of solution required will be 0.83×12 , or 10 gals.

Most of the chemical feeders or hypochlorinators have easily adjustable devices for controlling the rate of application. In combination with the ability to use a solution stronger or weaker than 1%, this permits great flexibility. It is desirable to operate the feeding machine somewhere near the middle of its capacity



The W&T orthotolidine-arsenite tester for determining free chlorine residuals.

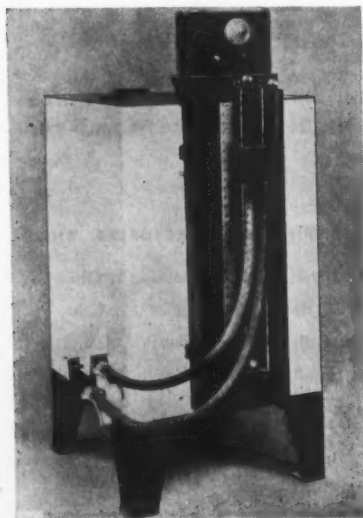
range. Where small volumes of water, as 25,000 or 50,000 gals. per day, are to be treated it may be desirable to use weaker solutions— $\frac{1}{2}\%$ or $\frac{1}{4}\%$. These are made by using two or four times as much water per pound of hypochlorite as is indicated above for the 1% solution.

Use With Ammonia

When chlorine and ammonia are used together (generally at the rate of about 1 ammonia to 4 chlorine), the chloramine residual is slower acting but longer lasting than is obtained by the usual type of chlorination; also heavier chlorine dosages are not so likely to cause complaints by consumers. A longer period of contact between the water and the chloramine before the water is used is necessary to insure that the organisms in the water are destroyed. However, the chloramine residual has the advantage that it may persist throughout the distribution system and prevent or reduce bacterial growths in the pipes. Equipment similar to hypochlorinators may be used to apply the ammonia, but the same machines cannot be used for both ammonia and chlorine. The ammonia, when used, is generally applied ahead of the chlorine.

Sterilizing Water Mains and Reservoirs

Every newly laid water main, and every main on which repair work might cause contamination of the pipe interior, should be sterilized before being put back into service. It is best to do this with the 1% solution of chlorine, injecting this with a feeder or hypochlorinator, into the main. Some of these machines will operate against pressures of 125 pounds or more. After the main has been flushed, the chlorine solution should be fed into the water entering the main, in amount to produce a residual chlorine concentration within the pipe of 10 to 50 ppm. The main



Omega "Precision" solution feeder, for hypochlorites, has a feeding range of 100:1. Feeds from $\frac{1}{25}$ gal. per hour up. Operates by electricity or spring motor.

SO USEFUL...
KEEP IT HANDY!



With HTH on hand, you're set for any hypo-chlorination need. Everyday chores like sterilizing reservoirs, filters, water tanks or new mains — these jobs get done *on the day* you want them done. And in emergencies, when there's a broken main to disinfect, or the power shuts off leaving your chlorinators useless, or a flood strikes — that's when you're glad to have HTH *within reach*. Better order a supply today. Ready for mailing is the brand-new 1948 edition of Mathieson's useful booklet: "Hypo-Chlorination of Water." Write for your copy. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y., formerly *The Mathieson Alkali Works (Inc.)*

Sanitation HTH... Liquid Chlorine... Chlorine Tablets...
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should be left filled with the heavily chlorinated water for 24 hours, then drained and flushed.

Reservoirs and tanks should also be sterilized before use, whether in the case of new construction or of repairs. The same general procedures should be followed as with pipe lines—flushing, filling with heavily chlorinated water, 24-hour contact, draining and final flushing.

Controlling Algae

Chlorine is effective in the control of algae, especially in settling tanks, channels, pipe lines and small reservoirs or clear wells. It is best to have the algae identified before attempting to treat it, and the State Sanitary Engineer will usually advise or help on this. Many species of algae are destroyed by chlorine dosages of 1.5 ppm. or less, with a contact period of 3 to 24 hours. If facilities for identification are not available, samples of the algae may be placed in solutions of 0.2, 0.5, etc., ppm. of chlorine for varying periods and the results used to establish an effective dosage. This may require some time which, in cases of heavy algae growths may not be available. In cases where dosages greater than about 1.5 ppm. of free available chlorine are used, consideration should be given to the possible effects on fish, if these are present. Application is usually in the form of a solution applied at the influent.

Advantages of Hypochlorination

In addition to their use in connection with small water supplies, hypochlorites are advantageous for emergency disinfection of mains, and for disinfection of wells, small gravity distribution systems and reservoirs. Also, "assuming the general availability of hypochlorite in a particular area where emergency disinfection is required, an engineer or chemist may go into the field without other equipment than a residual chlorine testing apparatus . . . and arrange for disinfection of smaller water supplies" (Mr. Weston). In swimming pools "where hypochlorinators can be used, we favor them from the standpoint of safety. They are also easy to maintain during long periods of disuse" (Mr. Waring).

Hints for Better Use

When calcium hypochlorite is used, the particles of lime in suspension tend to clog the small ports in the machine. Mixing well in advance of use (the day before) and allowing the mixture to settle well helps. In Michigan, calgon is added to keep the lime from precipitating in the

machine, and this helps a great deal in preventing trouble. Soda ash is also used, and in some places washing soda. The addition of $4\frac{3}{4}$ pounds of soda ash for each 5 pounds of hypochlorite results in the production of sodium hypochlorite and the nearly complete precipitation of the calcium. Sodium hypochlorite also may be purchased (as a solution) in carboys or similar containers. However, in some places changeover to the use of liquid sodium hypochlorite has resulted in difficulties because when the solution is diluted in accordance with directions for the stronger calcium hypochlorite solutions the dosage is often insufficient. Dosage must always be on the basis of chlorine content.

Every water works or swimming pool operator should maintain an inventory of parts which experience shows are likely to fail. Too often parts are ordered after failure, by letter, resulting in a considerable period during which the water is not chlorinated. "Lack of standby parts is matched in many communities by lack of stand-by operators. Only one man knows how to maintain and operate the hypochlorinator. As a result, chlorination may cease when the regular operator has an accident or gets sick." (Mr. Fassnacht).

Break-Point for Swimming Pools

Down in Texas, A. E. Stein has found that break-point chlorination is effective for swimming pools, especially fill-and-draw pools. He uses calcium hypochlorite. This treatment,

when applied to a clean pool, greatly retards the formation of algae, reduces the need for frequent cleaning, and keeps the water clear for a much longer period than with ordinary chlorination.

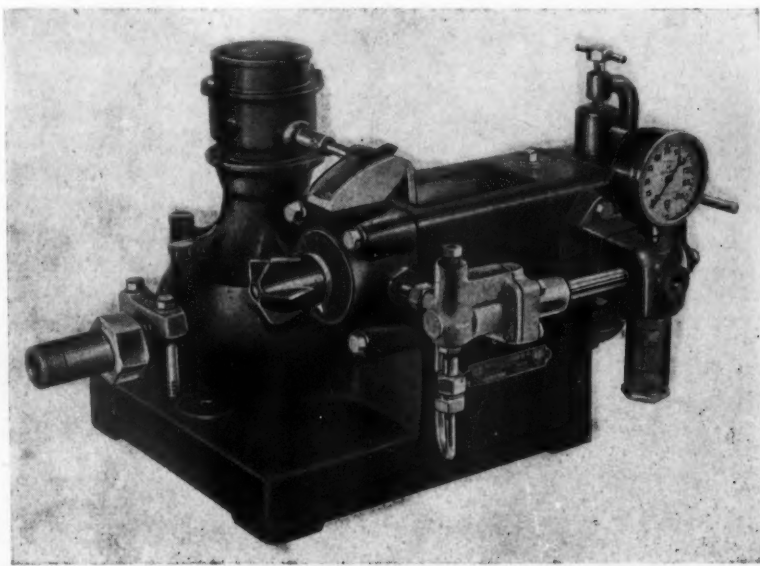
Air Terminal Traffic

(Continued from page 26)

Airport, a run of 15 miles, would be direct, non-stop, and completed in 15 minutes instead of 38, the present average; or that the 31 miles from Willow Run Airport to Cadillac Square could be covered in 31 minutes instead of about 70 at present. Or, if a traveler were more confident that in whatever direction his trip took him, he would find speedy, safe, comfortable and adequate ground connections, airports would be more profitable to those who build them by reason of increased use of their facilities.

Airport-to-business-district schedules in New York, Detroit and Chicago—and in perhaps twenty more cities in the highest brackets of airline passenger traffic—clearly call for a radical change in highway design, or perhaps for a new mode of transportation.

An experiment is under way in Cleveland, that could point the way to a future mode of city-airport communication. A company plans to operate a helicopter service between downtown Cleveland and its outlying airport. At this writing the service has not been started, but from

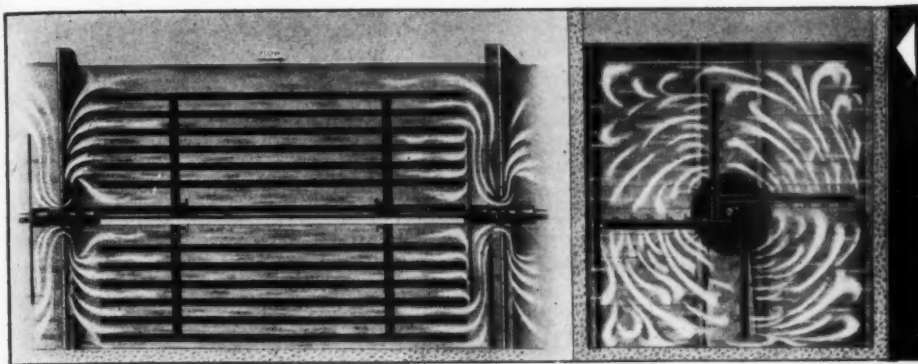


Wallace & Tiernan automatic hypochlorinator for small gravity supplies with wide flow variations. Electrically operated model is for small pumped supplies. Belt-driven unit can be synchronized with pumping engine.

REX

Water Treatment

EQUIPMENT

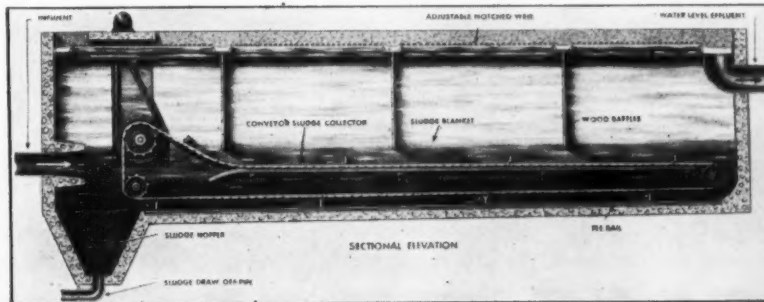
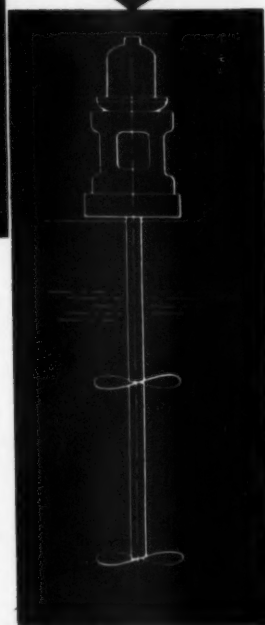
**REX FLOCTROL****REX FLASH MIXER**

REX FLOCTROL*Here's the greatest development in chemical mixing since the Langelier Multi-Stage Flocculation principle was introduced 25 years ago. The new Rex Floctrol is a unique combination of scientifically designed paddles, properly proportioned, rotating baffles and fixed partition walls with center ports, so arranged that thorough mixing is assured, and at the same time short-circuiting through the chamber is held to a minimum. Initial cost is low, and a minimum amount of chemical is required. Efficient use of horsepower, since none is wasted "bucking" the flow. Extremely flexible to suit any conditions. Thorough, ta-

*(Reg. U. S. Pat. Off.)

pered mixing by zones assures large, readily settleable floc. Write for Bulletin No. 48-39.

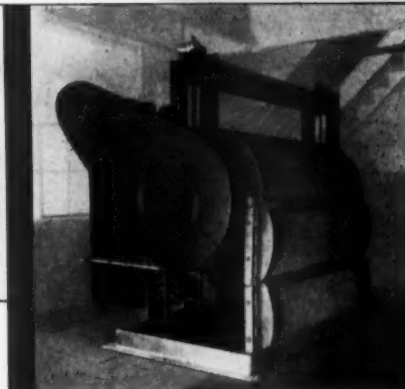
REX FLASH-MIXERS Rex Flash-Mixers effect an almost instantaneous dispersion of chemical throughout the water. Installed in a small tank immediately preceding the flocculation tanks, Rex Flash-Mixers provide a double mixing action, combining slow rotation with a fast top-to-bottom turnover for thorough mixing. A one-minute detention period is usually sufficient. A wide selection is available to fit almost any conditions. Rex Flash-Mixers are strongly built and precisely engineered to provide long life, quiet operation, and highly satisfactory performance.



REX VERTI-FLO CLARIFIER This vertical-flow, slurry blanket type of thickener employs a unique, exclusive, cellular construction obtained by dividing a conventional sedimentation basin with proper weirs and baffles. Extremely long weir length is

provided, and adjustable weirs allow close regulation of flow distribution among the cells. Tank capacity is vastly increased, water of extremely low turbidity is produced, resulting in longer filter runs, and a considerable saving in chemicals is achieved.

For the complete story on Rex Floctrol, Flash Mixers, Verti-Flo, Traveling Water Screens, Slo-Mixers, Conveyor Sludge Collectors, Tow-Bro Sludge Removers and the many other items in the complete Rex Line, send for your copy of Catalog No. 46-3. Chain Belt Company, 1722 West Bruce Street, Milwaukee 4, Wis.

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Built specifically for the job of screening the debris from intake water in water treatment plants, Rex Traveling Water Screens offer greatest capacity at lowest cost. Their effective seals between moving parts assure no passage of unscreened water. Efficient spray cleaning action assures low water consumption and easy maintenance. They are ruggedly built with fewer parts for low maintenance cost and long life.

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WATER TREATMENT EQUIPMENT

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an experimental point of view developments are being closely observed. The most obvious disadvantage is the limited capacity of a helicopter. But the idea is worth watching.

For pressing problems of the moment—and perhaps for some time to come—it seems obvious that highway transport will be the principal means of communication. For the time being, this throws us back to about where we started—the enhancement of road speed for airline ground connections.

New Planning Is Needed

While airlines have a direct interest in the quality and speed of surface transport facilities, there remains a fact that too few persons seem to remember—the airlines do not own airports. Nevertheless, the actual contractual arrangements necessary to have a motor carrier operating efficiently, regularly, and at a reasonable tariff, to and from an airport, are in almost every case between the airlines and a ground service contractor.

In the main, arrangements at most airports have worked out well. Yet air transport is growing so rapidly, the conception of airports as suburban centers of travel, recreation, and amusement is developing so fast, and increasing air cargo is adding so many trucks that a new line of planning is necessary for every city of a hundred thousand or more, and even in somewhat smaller communities.

It is not too visionary to say that airports of 10 and 20 years hence will be primary centers of community life. Certainly, with surveys showing so many persons using air terminals, there will be greater need for hotels in the vicinity, for restaurants, retail stores, theaters, swimming pools and all the other facilities that will bring urban convenience to outlying airports.

If this is true—and it is a definite trend in plans for Idlewild and Chicago municipal airports—then add the problem of afternoon and evening traffic from all directions and a considerable parking problem, also.

The Airport of the Future

Airports will be at increasingly greater distances from the centers of cities, but with ground transportation between them available at approximately a mile a minute, non-stop, with no traffic lights, passengers will be set down quickly at the waiting room. When the plane is ready, an elevator or escalator will connect with the landing level. The plane will leave on time. If arrival is at a simi-

larly-planned airport, passengers will de-plane, go to an adjacent platform and be sped downtown over a high-speed highway. If arrival is in the evening, or at night, a hotel, movie, and other accommodations will be available.

The things we are immediately concerned with here—the increase in speed of ground transport—are principally the problems of cities, counties, or similar political subdivisions. The composite situations are not too great to be overcome. Almost every community in the country has seen the necessity for building an airport. Fast transport between it and city terminals is a necessary adjunct to the kind of service demanded of the airlines.

In summary, what seems to be

needed is this: immediate, possibly temporary, airport traffic plans for larger centers of air traffic to relieve the present overcrowding of highways and to speed ground transport; and a long-range plan for airports of the future. Those who will plan these things can take a page from the experience of city traffic planners who are deluged with more automobiles and more car passengers than were dreamed of a quarter century ago.

Airports are increasingly important to the life of the community. No one knows where the volume of airline traffic will level off, but the views that have been taken of the future indicate that those who shall formulate these plans will do well to make them on a large scale.

Roads and Amenities

(Continued from page 32)

straight, road running along a valley containing a meandering river would provide, when viewed from the side of the valley, a sharp contrast unpleasing to most eyes.

In flat featureless country where there is no real reason, apart from that of amenity and avoidance of monotony, why the road should not run dead straight, it may be advisable to create obstacles (by, say, judicious tree planting) in order to give an apparent reason for curving the road. If the road deviates from the straight for no apparent reason, the fact is apt to irritate the logical mind. Small variations in gradient may also be seized upon as an excuse for deviation.

The vertical alignment of a road may involve the construction of embankments or cuttings. These, as far as possible, should be moulded into the natural topography by avoiding a too rigid adherence to standard batters, and by rounding off sharp edges at the tops of cuttings, or softening the outlines by planting shrubs.

Road Components

In dual carriageway roads interest and variety can be achieved by varying the distance between the carriageways and varying their relative levels. The levels, however, should not differ greatly unless the distance between the carriageways is sufficient to prevent a motorist on the lower carriageway feeling "overlooked" by the upper carriageway. Similarly the distance between carriageway and footway may be varied.

Whether much can be done to preserve or provide amenity by the actual

method of construction of the carriageway is debatable, but the subject is worthy of consideration, and many people would agree, for instance, that bituminous surfacing harmonise more readily with rugged and semi-wild country than do concrete surfaces, chiefly because they look less artificial. Conversely concrete carriageways harmonise with highly cultivated rolling country where the obvious handiwork of man does not look out of place.

Pleasant effects can sometimes be achieved by adding pigments to concrete in order to colour it, or by brushing the surface lightly while the concrete is still green in order to expose the aggregate.

The Ministry of Transport's publication on "The Design and Layout of Roads" makes the often overlooked point that, "as far as practicable, repairs should be carried out with materials to match those originally used, in order to avoid ugly scars on the road surface." A stretch of concrete road disfigured with shapeless patches of asphalt is a not uncommon sight.

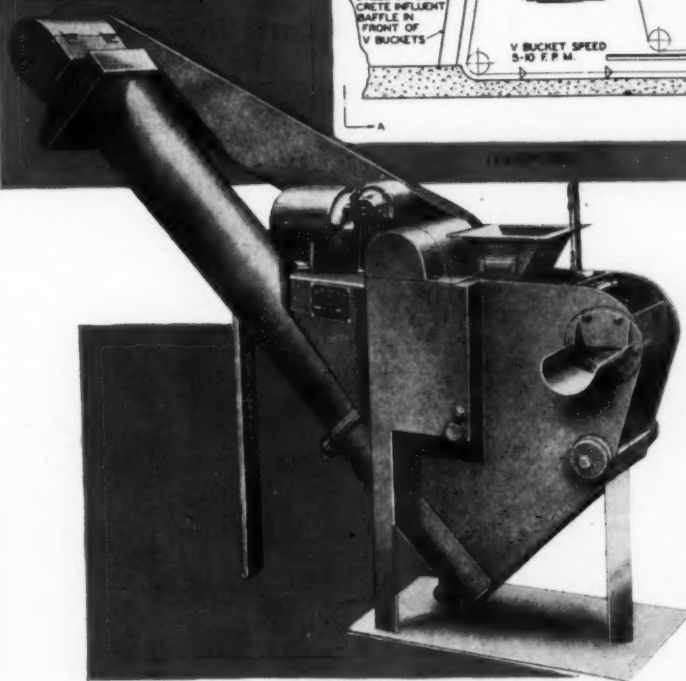
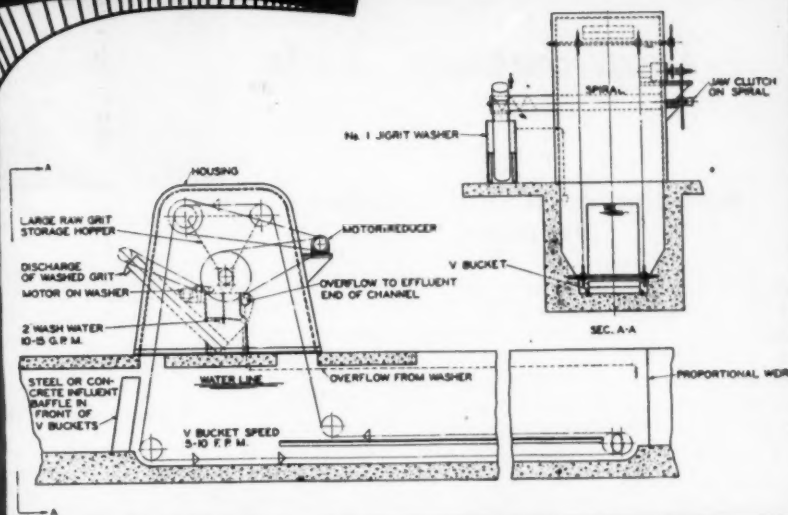
Kerbs tend to divorce the carriageway from its surroundings, and may sometimes be omitted to advantage.

The treatment of verges and central reservations is a matter of great importance, and, in the countryside, where planting of some sort is usually involved, it is necessary to obtain horticultural advice. Before any scheme of planting is decided upon the conditions of soil, climate, water table and orientation to the sun must be considered. It is important that

(Continued on page 48)

85% REMOVAL OF ORGANICS with "JIGRIT" WASHERS

Satisfactory and efficient grit washing is possible in any size community by using the Jeffrey system (see drawing) of grit collection and washing. Our field studies show that the best results the grit should be collected by one mechanism and washed in a separate unit. Automatic control makes it possible to operate each device a minimum time each day.



Left — Jeffrey "JIGRIT" No. 1 — a basket type jig for classifying and removing putrescible solids from sewage grit in plants of moderate size. Capacity — 20 cubic feet per hour. 90% recovery of inorganic grit. Produces a washed grit that can be used for fill or dumped anywhere without nuisance. Also No. 4 "JIGRIT" washer for washing grit at rate of 120 cubic feet per hour, and No. 9 for 280 cubic feet per hour . . . in single units fully automatic in operation.

Bar Screens • Sludge Collectors • Sludge Elevators • Grit Collectors • Screenings Grinders
Garbage Grinders • Conveyors, Chains and Bearings • also equipment for biofiltration plants

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Engineering Data

Inserting a 48" Valve Under Pressure

In order to provide for a by-pass at a large steel mill, it was necessary to install a 48" gate valve in a 30-year old cast iron main carrying sea water. The mill could not shut down even temporarily, so the A. P. Smith Mfg. Co. was asked to insert the valve under pressure. This was done in 4 days, without interruption in service or reduction in pressure in the main. This is believed to be the first 48" insertion ever made under pressure; but later a similar job was done for the Water Bureau of Philadelphia.

A 2700-Ft. Line to Serve 12 Customers

H. A. GILBERT

Secty. & Treas., Water Dept., Corry, Pa.

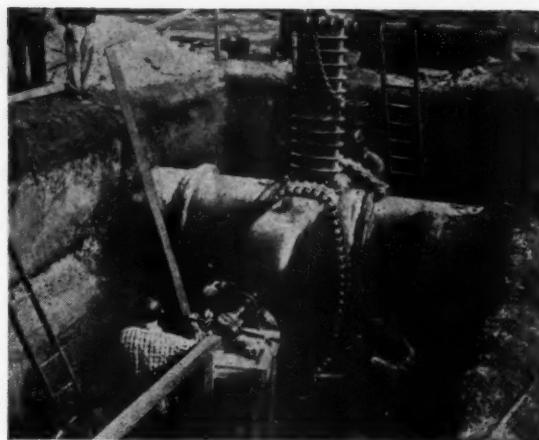
THE Corry (Pa.) Water Supply Co., in order to serve an area of small farms and scattered houses, decided to lay a 1-inch copper line. The total length was 2,700 feet of 1-inch followed by 120 feet of ¾-inch, all copper. In addition there was a saw mill located outside the city limits. To serve this customer a meter pit was installed and from this point the customer continued with 1,800 feet of ¾-inch copper tubing.

There was a creek crossing consisting of a concrete box covered with about two feet of dirt. This cover was not enough to protect the line against freezing, and at this point the copper pipe was laid inside a 4-inch pipe and the space packed with mineral wool. On either side of the crossing the pipe turns sharply downward below the frost level.

The line has been entirely satisfactory and there have been no complaints of lack of pressure. The initial pressure was very high, approximately 120 pounds per square inch. The flow, measured through a ½" x ⅝" meter, was 36 cubic feet per hour. This flow was realized through a ½" compression stop valve at the end of the line. While this valve was open full the pressure was tested at various points along the line and at no point was there a noticeable lack of pressure.

The number of customers served was 12 in addition to the saw mill.

A larger line than this would not have been economically justified for the reason that there was a considerable extent of low ground where the prospects of future construction were nil; and further, the people in this area had no intention of subdividing their land but chose the location in order to have ample frontage.



Inserting a 48" gate valve under pressure.

The cost of trenching was \$496. The cost of back-fill was \$136. The back-hoe and bulldozer were employed by the hour. The cost of labor for laying and connecting the pipe, for supervision and test, trimming the back-fill, etc., was \$348. The total cost was \$980.

Construction Costs in Vermont

The following selected bid prices are from the Vermont Highway Department, and are for bids opened on July 16, 1948. Bids (a) are on Montpelier U 56 (11); and (b) are on Arlington F 141 (1).

Solid Rock Excavation: (a) 1,750 cu. yds., two bidders, low \$2; high \$12. (b) 4,700 cu. yds., seven bidders, low, \$3; high, \$4.

Rock Excavation, Trench: (a) 300 cu. yds., both bidders, \$10. (b) 185 cu. yds., seven bidders, low, \$5; high, \$8.

Common Excavation, Including Borrow: (a) 7,500 cu. yds., low, \$1.25; high, \$1.50. (b) 15,500 cu. yds., low bidder, 53¢; high bidder, \$1.40.

Earth Excavation, Trench: (a) 6,500 cu. yds., both bidders, \$3.50. (b) 680 cu. yds. low bidder, \$1.50; high bidder, \$3.

Structure Excavation: (a) 2,100 cu. yds., low, \$7; high, \$10. (b) 95 cu. yds., bids, \$3, \$4, \$5, \$7, \$8, \$10 and \$20.

Concrete, Class A: (a) 840 cu. yds., \$48 and \$50. (b) 32 cu. yds., \$45, \$50, \$55, \$58, \$60, \$65 and \$75.

18" Reinforced Concrete Pipe: (a) 800 ft., \$3.45 and \$3.50; (b) 700 ft., low, \$3.20; high, \$3.75.

24" Reinforced Concrete Pipe: (a) 888 ft., \$5 and \$5.10. (b) 148 ft., low, \$4.75; high, \$5.

Cutting and Removing Trees: (a) 30 trees, low, \$75; high \$100. (b) 195 trees, low, \$24; high, \$45.

There was about 1% difference in the total of the two bids on project (a). The bids on (b) totaled: \$98,970; \$99,099; \$101,592; \$105,936; \$107,478; \$143,669; and \$144,340.

Bid Prices of Water Lines and Sewers

Bids were received July 16, for the construction of buildings, sewer lines, water mains, and other preliminary construction work on the Fort Randall Reservoir Project, near Lake Andes, S. D. Following are some items from the bids received. Estimates are "reasonable without profit."

Water Lines.—8-inch 2,700 ft., estimate without

profit,
3,180
\$5.50
\$2.70
\$115.6
valve-
Fire 1
\$250.
Sea
\$2.75
3,530
8.1 to
\$3.25
\$3.40
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profit, \$4.89 per ft.; low bids, \$6.30 and \$6.50; 6-inch, 3,180 ft., estimate, \$3.82 per ft.; low bids, \$5.30 and \$5.50; 2-inch, 2,600 ft., estimate, \$1.83; low bids, \$2.70 and \$3.25; 8-inch valve and valve-box, estimate, \$115.62; low bids, \$145 and \$154; 6-inch valve and valve-box, estimate, \$90.18; low bids, \$110 and \$131. Fire hydrants, estimate, \$194.81; low bids, \$235 and \$250.

Sewers.—8-inch, 0 to 6 ft. deep, 720 ft., estimate, \$2.75; low bids, \$2.65 and \$2.75; 6.1 to 8 ft. deep, 3,530 ft., estimate, \$3.27; low bids, \$2.90 and \$3.; 8.1 to 10 ft., estimate, \$3.57; low bids, \$3.15 and \$3.25; 10.1 to 12 ft., 510 ft., estimate, \$3.71; low bids, \$3.40 and \$3.50; 12.1 to 14 ft., 290 ft., estimate, \$4.04; low bids, \$3.90 and \$4.25.

6-inch, 0 to 6 ft. deep, 1,620 ft., estimate, \$2.34; low bids, \$2.10 and \$2.50; 6.1 to 8 ft. deep, 1,900 ft., estimate, \$2.99; low bids, \$2.60 and \$2.70. **Standard manholes**, 23, estimate, \$221.40; low bids, \$190 and \$195. Additional depth, per ft., estimate, \$26.18; low bids, \$30 and \$30.

New Impeller Reduces Pumping Costs

By installing a new and more efficient impeller in a 6 mgd. pump at the Quittacas Pumping Station, New Bedford, Mass., Water Department, the cost of pumping water to the High Hill Reservoir was reduced from \$12.61 per mg. in 1946 to \$11.85 per mg. in 1947.

The Water Department also reported, in its 1947 annual report, that cleaning of old cast iron mains in place has produced excellent results. In one case, the cleaning of an 8-inch main doubled the flow of water available at one industry.

The maximum daily consumption of water in 1947, for a 24-hour period occurred on Monday, Aug. 25, when the flow amounted to 20,044,874 gals. The minimum daily consumption occurred on Sunday, March 2, when the flow was 8,712,282 gals. The average daily consumption—6 AM to 6 PM—was 8,799,050 gals.; and the average night consumption—6 PM to 6 AM—was 6,177,595 gals.

Bid Prices, 30" and 36" Pipe, to 24 Ft. Deep

Bids were received on June 29, by the Army, for work in connection with the Wolf River Project near Memphis. Contract prices for pipe construction were:

30-inch Pipe

Depth 0 to 8 ft., 232 ft., \$21 per ft.; 8.1 to 10 ft., 377 ft., \$23; 10.1 to 12 ft. deep, 364 ft., \$25; 12.1 to 14 ft. deep, 1,461 ft., \$27 per ft.; 14.1 to 16 ft. deep, 583 ft., \$31; 16.1 to 18 ft. deep, 235 ft., \$33; 18.1 ft. and deeper, 228 ft., \$35.

36-inch Pipe

Depth 0 to 10 ft., 107 ft., \$28; 10.1 to 12 ft. deep, 274 ft., \$30; 12.1 ft. to 14 ft., 23 ft., \$32; 14.1 to 16 ft., 497 ft., \$36; 16.1 to 18 ft., 75 ft., \$41; 18.1 to 20 ft. deep, 335 ft., \$46 per ft.; 20.1 ft. to 22 ft., 769 ft., \$51 per ft.; 22.1 to 24 ft., 608 ft., \$60 per ft.; 24.1 ft. and deeper, 473 ft., \$67 per ft.

The prices, as awarded, were considerably above the government estimate. For instance, the estimate on the 36" pipe for depths of 10.1 to 12 ft. was \$11.71, while the bid price was \$30. The 30" pipe, for depths of 14.1 to 16 ft. was estimated to cost \$12.16 per ft., but the bid price was \$31.

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shows you the complete new line of Jaeger "AIR PLUS" Portable and Stationary units that give you more air but cost no more.

600 cfm

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THE JAEGER MACHINE CO.

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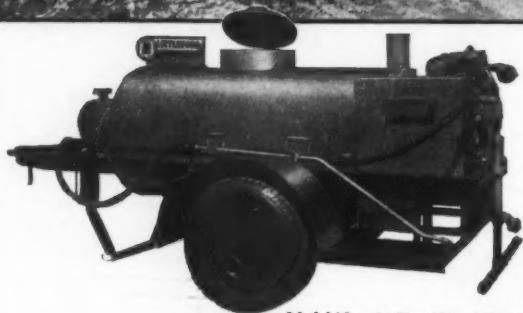
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Traffic Marking Standards in Ohio

To avoid confusion on the part of motorists, Ohio has adopted a standard system of traffic markings. All center lines, when required, will be white; yellow will not be used for centerlines, but will be used exclusively as an auxiliary line parallel to the normal center line to indicate zones where the view is restricted and passing is unsafe. A yellow line on the driver's side of the centerline indicates a no-passing zone. A manual has been issued which outlines the standards to be used for these situations, and for approaches to railroad crossings, approaches to highway intersections, stop lines, crosswalk lines, parking stalls, safety zones and islands.

Kern County Has Traveling Blacksmith Shop

Kern County is the third largest county in California, with 8,170 sq. miles of area. A blacksmith and welding shop was mounted on a Mack truck chassis and is used to service county equipment. The area and distances involved were such that the innovation has been very successful.

Preventing Oil Contamination of Water Supply

Last April, a valve in a fuel oil pipe line crossing the watershed of Tonawanda Creek, from which Batavia, N. Y., obtains its water supply, ruptured and considerable oil escaped into fields and entered the creek before repairs could be made.

The pipe line company set the pools of oil on fire in an effort to consume the oil. While this was not wholly successful it did reduce the amount which entered the creek. When this oil-laden water reached the intake of the supply, the filter plant was immediately shut down and the city was supplied with water from storage.

A wooden deflecting wall was constructed outside the intake. A compressor was installed near the intake and compressed air was forced into the creek water just outside the intake. The rising air largely succeeded in preventing oil from being drawn down into the intake, as only a few small drops of oil were observed in the raw water samples when the plant was again placed in operation. The dose of activated carbon was increased to remove any oil which passed through the intake into the sedimentation basin.—*New York State Water Works News.*

Costs of Testing, Installing and Repairing Meters

Data are given in the 1947 report of Detroit, Mich., on the various costs connected with the installation and repair of meters. A total of 27,981 $\frac{5}{8}$ " meters were tested at an average cost of 11.3¢ each. Unit costs on other sizes were $\frac{3}{4}$ ", 15¢; 1", 31¢; $1\frac{1}{2}$ ", 85¢; 2", \$1.05; 3", \$3.79; 4", \$6.06; and 6", \$9.09.

Costs of setting meters were as follows: $\frac{5}{8}$ ", 5,994, \$11.22 each for installing; $\frac{3}{4}$ ", 462 set, \$16.51 each; 1", 310 set, \$23.53; $1\frac{1}{2}$ ", 115 set, \$49.27 each; 2", 83 set, \$76.64 each; 4" compound, 7 set, \$356.39 each; 6" compound, 6 set, \$705.88 each; and 6" detector check, 6 set, \$155.19 each. These costs included labor, cartage and materials.

Damaged meters were repaired at the following unit costs: $\frac{5}{8}$ " damaged by frost \$2.96, by hot water

\$3.33 and by wear and tear \$2.87. For $\frac{3}{4}$ " meters, the unit costs were: damaged by frost \$3.25, by hot water \$3.99 and by wear and tear \$3.33. For 1" meters unit costs were: damaged by frost \$4.44, by hot water \$5.08 and by wear and tear \$3.59. For $1\frac{1}{2}$ " meters the costs each were, respectively, \$9.69, \$12.74 and \$6.10; and for 2" meters, \$9.56, \$15.55 and \$6.70.

Construction Volume Increases

Contract volume in the first six months of this year, according to F. W. Dodge Corp., was 36% higher than for the corresponding period of 1947. The greatest gains were in non-residential building, but engineering works showed a gain of 26%. The 6-month total for the country for heavy engineering awards was \$1,083,573,000.

Some Causes for High Bacterial Counts in Maryland Water Supplies

In the 1947 report of the Maryland Bureau of Sanitary Engineering, of which George L. Hall is chief engineer, resumes were given of experiences in several communities where high bacterial counts had persisted. In Centerville, bacteriological results of tap samples collected throughout the distribution system has not been satisfactory since 1945. While the reasons for the unsatisfactory samples have not been fully determined, complaints due to the presence of what appeared to be oil in the water resulted in finding that the oil cups on the deep well turbine were improperly used. The supply is from deep wells, and chlorination is being utilized to insure that the water is safe.

In Lonaconing-Midland, unsatisfactory samples resulted in a survey of the watershed of Elklick Run. It was found that some pollution could get into the stream, and that chlorination was intermittent. In addition to maintaining an adequate chlorine residual, a settling basin will be added.

Bad samples at St. Mary's Seminary resulted in a survey which disclosed that birds could enter the elevated tank through openings under the roof. When these were properly screened, contamination disappeared. At St. Michaels, bacteriological findings indicated entrance of pollution. Though a survey was made, no specific source of pollution was found, and it was believed that the pollution may be due to cross-connections in the distribution system.

Average Hourly Wage Rates, Second Quarter, 1948

Information on average hourly wage rates, by geographic divisions of the country, for the second quarter of 1948, has been issued by the Public Roads Administration. These show the following averages: For executive, administrative and supervisory personnel, nation-wide average, \$1.70 per hour, with a high of \$2.09 in the Pacific states and a low of \$1.46 in the East South Central states. For skilled labor, nation-wide average, \$1.76, with a high of \$2.20 per hour in the Middle Atlantic States and a low of \$1.51 in the East South Central. For intermediate grade labor, nation-wide average, \$1.25 per hour, with a high of \$1.75 in the Pacific States and a low of \$1.07 in the South Atlantic states. For unskilled labor, nation-wide average, 95¢ per hour, with a high of \$1.54 in the Pacific states and a low of 70¢ in the East South Central states.



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Roads and Amenities

(Continued from page 42)

the top-soil should not be removed from the verges during the progress of the road works. The choice of species of trees or shrubs will depend upon the site conditions mentioned above in addition to aesthetic considerations, and assistance in these matters can be obtained from the Roads Beautifying Association.

Roadside trees are usually planted in avenues, but the effect of well-sited

clumps of trees can often be used to advantage.

Some form of physical boundary is almost invariably necessary at the edges of the roadway except in the wildest of country, and these physical boundaries, such as fences or hedges, are therefore considered as a road component rather than an ancillary. In choosing the form that these boundaries should take the usual principle of harmony with the terrain must be kept in mind. Fencing should generally be supplemented by hedge planting, as most

readily available types of fence are unsightly. Dry-walling is indigenous to some parts of the country, and anything else is out of place.

Road Ancillaries

Even on single purpose roads, such as motorways, where frontage building is prohibited, there will have to be certain buildings whose function is to serve the traveller. These will include petrol stations, transport cafés with pull-in vehicle parks, bus passenger shelters, emergency telephone kiosks and so on. If the amenities of the road are not to be spoilt, it is essential that their siting and design should be stringently controlled, and that the present-day horrors in corrugated iron should become things of the past. Indeed, it is arguable that, in the case of a single purpose motorway, they should be designed as an integral part of the road scheme, and operated by the highway authority. The powers of development control given to planning authorities in the 1947 Town and Country Planning Act, particularly in respect of the control of the display of outdoor advertisements, should do much to improve the amenity of roads.

Serious attention should be given to the design of lamp standards, bollards and signposts. Such equipment is all too frequently mass-produced by some local foundry or pre-cast concrete works with little regard to its appearance.

Conclusion

If the foregoing paragraphs have served to emphasize the importance of amenity in the planning of roads through the countryside, and to point out the many aspects of the problems involved, then the purpose of this article has been achieved. The appreciation of those problems now, and a continual striving for their solution, should lead to greater pleasure for motorist and pedestrian in the years to come.

Joints for a 25" Thick 10,000-ft. Runway

The job of building a 10,000-ft. concrete runway at Patterson Field, Dayton, Ohio, was recently completed, the slab being as much as 25" thick. Dummy joints were used instead of expansion joints because of the thickness of the slab. These joints and the longitudinal joints were sealed with Careylastic sealing compound. (Philip Carey Mfg. Company) which is a mixture of rubbers, asphalts and suitable plasticizers that will retain its plastic and elastic properties at both winter and summer temperatures.



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This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

The Highway and Airport Digest

The World's First Aluminum Highway Bridge

Construction has begun on an all-aluminum highway bridge (said to be the first in the world) across the Saguenay river. It will have a main arch span of 290 ft. and approach spans bringing the total length to 504 ft. The width is 24 ft. between curbs plus a 4 ft. sidewalk on each side. It will weigh about 400,000 lb. as compared with 800,000 lb. for a steel bridge of the same dimensions. The specified live load is U-100.

J. S. Walsh—"Arvida, Que., to Have World's First Aluminum Highway Bridge," Roads & Bridges, Pp. 61, 95.

Sand Drains In Puerto Rico

In 1942 it was proposed to construct 0.34 mi. of 4-lane highway across a marsh in Puerto Rico. The soil

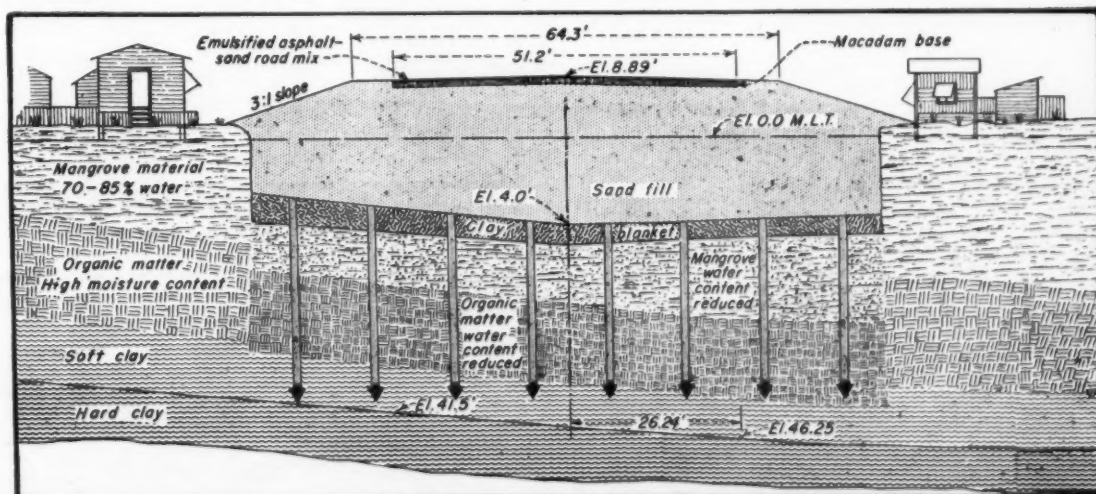


Aluminum highway bridge over Saguenay River in Quebec.

Courtesy Roads & Bridges

consisted of about 25 ft. depth of mangrove material that was 70-85% water; under this about 15 ft. of organic matter with a high moisture content; then 5-8 ft. of soft clay on hard clay. Plans considered included a concrete trestle,

a sheet-piled trench filled with sand; and a plank floor on timber piles. But the sand drain method as used in California was estimated to cost only 60% to 17% as much as the others and was adopted. Work was begun in Novem-



Method of installing sand drains for Puerto Rico road.

Courtesy Engineering News-Record

ber, 1942, by covering the roadway site with a clay blanket 2 ft. to 6 ft. thick and about 100 ft. wide and in Dec. the driving of the 1492 drains was begun. These were made with 40 ft. lengths of 12" steel pipe (30" pipe was preferred but was unobtainable) spaced 11.8 ft. transversely and 9.8 ft. longitudinally and filled with sand all of which passed a $\frac{1}{2}$ " sieve. The clay blanket then was covered with 10 to 20 ft. of sand placed in a succession of 12" layers during a period of about 3 years. This squeezed out of the muck much of its water content, which was about 80% originally. There was no bulging of the marsh surface outside the fill. The fill was surfaced and opened to traffic in August, 1946. During the two years immediately prior to this, the fill had settled only 9" and no serious difficulty from future settlement seemed likely.

J. C. Carpenter—"Stabilize Muck in Puerto Rico;" Eng. News-Record, July 22, Pp. 52-54.

Pumping a Highway Fill

A fill for a highway along the edge of the Columbia river in Oregon is being made by hydraulic dredging from the river bed, a total fill of 9,000,000 cu. yd. being required. A rock toe wall was built first along the outer edge to hold the fill in place, and a dike built along it by means of a dragline. As the fill material is dis-

charged behind the dike from the 30" dredge pipe, a bulldozer makes terraces across the roadway to form deposit basins. The average rate of fill is 20,000 cu. yd. per 8-hr. day, and 35,000 cu. yd. has been reached.

Construction Methods, August, Pp. 74-76.

Non-Skidding Asphaltic Concrete

The author found that the skid-resistance of new or resurfaced bituminous concrete roads often differed considerably even though the treatment apparently had been the same in all cases. From experiments made in 1947 on the Velp-Arnheim highway he concluded that the temperature of the air at the time of applying the seal coat was largely responsible for the difference; and that it is desirable not to apply a seal coat to bituminous concrete when the average day temperature is less than 10° C. If applied when the average day temperature is 7° or 8°, the surfaces are apt to become slippery, in some cases extremely so. During cold weather it may be possible to roughen a slippery surface by a treatment with turpentine combined with sand blasting, raising the coefficient of resistance to 0.55 or 0.60. The cost is rather high—about 7 or 8 cts. per sq. yd.

J. C. Hoornenborg—"Stroefheid van Nieuwe Asfaltbetonwegen;" Wegen, July, Pp. 138-140.

Low-Cost Paving in Arizona

By the end of this year Glendale, Ariz., will be 100% paved, instead of only 15% in 1947. This rapid increase was due to both population growth and desire to eliminate dust and mud. Because of the mild climate, a thinner pavement was considered practicable than would be used where the soil freezes and thaws, and that adopted was a 6" aggregate base, with a 2" asphaltic surface (5% SC-6) in residential districts and 2½" asphaltic concrete in the business section. Contract prices averaged 33.5 ct. per sq. yd. for grading, 43 ct. for base course, 57 ct. for 2" surface course and 75 ct. for 2½".

Dean E. Smith—"How Glendale, Ariz., Settled the Dust;" PUBLIC WORKS, August, Pp. 30-31.

Difficult Construction on North Santiam Highway

Of immense importance to the development of Oregon is the highway through the valley of the North Santiam river. At present this is little more than a truck trail. Plans made several years ago to improve 12 miles of it at a cost of \$1,260,000 had to be scrapped and replaced with a relocation 15.6 miles long on the steep side of a canyon, estimated to cost \$3,600,000 (\$5,700,000 at present prices) because of the proposed damming of the river under the War De-

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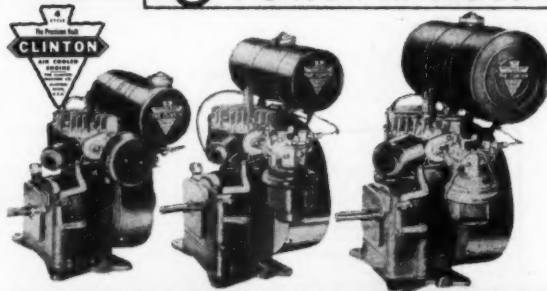
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partment's Willamette Valley flood control plan, which will create a reservoir that will cover the original location of the road. (This additional cost will be borne as part of that of the flood control plan). One section of the new highway will cost \$770,000 a mile.

The maximum grade is 2.5% (6% for one 1610 ft. stretch). Max. curvature, 11° for a total of 104°. Sub-grade width 32 ft. Surface width 28 ft., of 8" of crushed rock surfacing on 12" of ballast. The material to be excavated ranges from black muck to rock that dulled the drills in 2" of penetration, and the nature of the material varied radically at intervals of a few hundred feet only. For this reason field redesign was an important factor in securing maximum economy, balancing quantities and maintaining standard requirements.

Another problem was the safety of fills should they extend into the reservoir; if this be drawn down rapidly, the water-soaked fills might slide. Therefore most of the fills were so located as to keep the toe above the reservoir water, necessitating raising the grade to a maximum of 145 feet above pool level, at a cost of \$500,000 more than a grade only 20 ft. above such level.

The most interesting structure on the project is a 400-ft. trestle-type half bridge of reinforced concrete, built on three spirals and part of a 7-deg. simple curve. This bridge hugs a steep rock cliff where one half of the roadway is benched in solid rock and the remainder is supported on long columns 6 sq. ft. in cross section. Outside columns have a maximum length of 44 ft.; inside columns, 22 ft. The bridge is of slab-and-girder construction, heavily reinforced.

J. F. Cameron—"North Santiam Highway Follows Difficult Route Near Cascade Summit;" Civil Engineering, August, pp. 40-45.

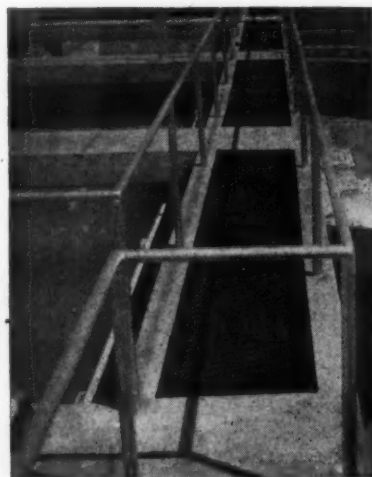
Limestone Base in Miami

Miami, Fla., uses local limestone for its pavements, a soft limestone taken from above the water table for base material, and that from below the water table, which is hard and crystalline, for the wearing surface and for concrete. In making a base, a 5" layer (or two 4" ones in some cases) is spread and worked by a grader into a fine, pulverized condition, soft and sticky. Then it is shaped and compacted with 10-ton steel-tired rollers until of practically the density of the original rock. Limestone used for base construction must contain at least 70% calcium carbonate, with the balance probably silica. That for the surface must show not more than 35% wear by the Duval abrasion test. About 450 miles of Miami's streets have been built with this base, and stand up well unless flood water stands above it, when it softens.

Incidentally, gutters are seldom paved, the sandy soil absorbing the

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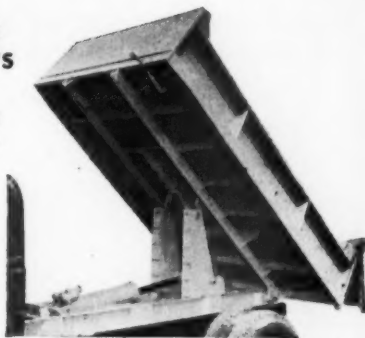
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rainfall rapidly. Any paved gutters are drained to seepage basins—ordinary catch basins with the underlying stratum of limestone dynamited.

Redecking Timber Bridges

Last year the Alabama Highway Dept. redecked with concrete a total of 1820 ft. of old timber bridges whose plank flooring and timber guard rails were worn out. The old bridges were of 15, 17 and 19 ft. spans, roadways 20 ft. wide, designed for H-10 loading. The 4-pile bents and caps and most of the stringers—all treated timber—were in excellent condition and able to carry a roadway 24 ft. wide and the added load of concrete slab and an H-15 live load. But five additional stringers were added, changing stringer spacing from 18" to 16" c to c to carry the additional load, and defective ones replaced. Also a false cap was placed between pile cap (which was lowered) and stringers, cantilevering at both ends to carry the additional width and the roadway curbs.

The concrete floor was placed for a width of one lane at a time, leaving half the width open for traffic. An innovation was the use, instead of forms between stringers to support the slab concrete, of a special wire-reinforced paper fabric stretched tightly over the stringers and fastened to each stringer with 1½" staples spaced 6". This

fabric ("Steelex" floor lath) comes in rolls of 12 lin. ft. 4 ft. wide. It is reinforced with jute cord and No. 12 welded wire fabric. The redecking was performed by the state maintenance crews at an average cost of \$38 per lin. ft. of bridge.

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Establishment of a County Highway Laboratory. By J. N. Taylor, Asst. County Engr., and E. A. Cox, Chf. Laboratory Engr., West Riding of Yorkshire County. July 23, Pp. 381-383.

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How We Built a Low Cost Stabilized Road. By Edward Winkel. August, Pp. 23-24.
Glendale, Arizona, Settles the Dust. By Dean Smith. August, Pp. 30-31.
Load Tests of Soil Bearing Capacity. August, P. 36.

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The Sewerage Digest

Safety in Treatment Plants

Accident prevention in sewage treatment plants is the responsibility of both designer and operator. The hazards include gas hazards arising from the production and utilization of sewage sludge gas; physical hazards arising from the possibilities of falls, drowning, electrocution, etc.; and health hazards from the many sources of infection and disease. Gas hazards include explosions and those due to toxic and suffocating properties. Many physical hazards can be minimized by generous use of handrails around open tanks and wells and on stairs and platforms; by making walks and floors non-slip; minimizing use of ladders; adequate lighting; observation of the requirements of the National Electrical Code. There should be a supply of safe water and ample facilities for personal cleanliness of employees; toilet, medicine chest and first aid items. So far as possible, actual contact with the sewage should be made unnecessary; the use of rubber gloves will minimize the hazard of exposure to infectious material when hand contact with sewage is necessary, and such contact should be followed immediately with copious use of soap and water.

H. S. Smith—"Safety Measures in Sewage Treatment Plants," *Sew. Wks. Jour.*, July, Pp. 744-752.

Performance of Biological Filters

The author has developed "a basic expression suitable for the explanation and prediction of the performance of biological beds," applicable to both low-rate and high-rate trickling filters. This is based on the theory that "The rate of extraction of organic matter per interval of depth of a biological bed is proportional to the remaining concentration of organic matter, measured in terms of its removability." Not all of the B.O.D. applied to a biological bed is removable, even by the repeated passages or by a very deep bed. The removable fraction is dependent upon the proportion of the B.O.D. in suspended and colloidal form as distinct from that in true solution, and decreases as the rate of application increases. The quantity of B.O.D. which can be assimilated by the biological life of a bed is limited, and the limiting B.O.D. load is a function of the rate of biological oxidation and the storage capacity for accumulation of B.O.D. within the bed. As biological oxidation is a temperature function, the limiting load is lower during cold weather.

The logarithmic rate of extraction and the magnitude of the removable

fraction must be determined experimentally for each particular type of bed. Using such data as he could discover, the author finds that for high-rate beds the limiting load appears to be approximately 1 lb. of 5-day B.O.D. per sq. ft. per day at 30° C; as the load exceeds this, the removal decreases. The removal by a bed of infinite depth and 1 lb. load would be 0.784 lb. per sq. ft., and for a 3 ft. bed would be 0.508 lb.; which would be reduced to 0.391 lb. at a loading of 1.3 lb. per sq. ft. Application of this method indicates that recirculation or series treatment can increase the removal but slightly if the filter is 6 or 8 ft. deep, but give a substantial increase with a 3 ft. filter.

C. J. Velz—"A Basic Law for the Performance of Biological Filters," *Sewage Works Journal*, July, Pp. 607-617.

Continuous Flow In Sewage Treatment

The history of sewage treatment shows that continuous-flow operation always yields better performance than any sort of intermittent process. Fill-and-draw sedimentation tanks have been succeeded by continuous flow; contact beds, by trickling filters; intermittent dosing of trickling filters is being supplanted by continuous flow of high-rate filters; gas production by sludge digestion increases as the addition and withdrawal of sludge approaches the continuous; a basic claim of the activated sludge patent is the

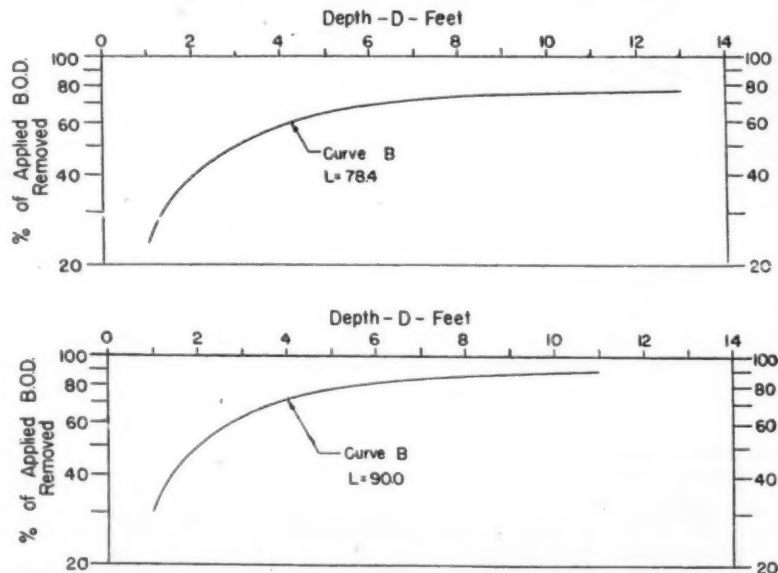
continuous flow through the aeration tank. "One can only advise investigators who concern themselves with the field of sewage treatment not to strike out on the detour of intermittent flow in future work, or even to fall back on it, but to strive constantly for the continuous-flow process."

Karl Imhoff—"The Continuous-Flow Principle in Sewage Treatment," *Sewage Works Journal*, July, Pp. 626-628.

Measuring Treatment Efficiency by O-R Potential

O-R potential is defined as "the electric pressure existing in a liquid as a result of the respective concentrations of oxidant and reductant present." "Oxidant" embraces the forces present that increase the proportion of oxygen or acid-forming elements, or radicals, in the compounds contained in the liquid. "Reductant" represents the forces present that increase the proportion of hydrogen or base-forming elements. For determining O-R potential the author uses a potentiometer equipped with a platinum electrode and calomel cell.

O-R potential measurements may be used for detection of deposits or growths in sewers or pumping stations leading to septicity or sulfide production; for detection of industrial wastes, of toxic conditions, of over-long detention in primary tanks, of internal conditions within filters, of excessive sludge blanket in activated sludge settling tanks, and other conditions.



Removal of BOD, as percentage of applied load, in passing through beds of depth D. Upper curve high rate filters; lower curve low rate filters.

Courtesy: Sewage Works Journal

Discussing this paper, Prof. G. A. Rohlich said that this process involves several difficulties. Erratic results often occur due to "poisoning" of the platinum electrodes. "In a complex heterogeneous mixture such as activated sludge and sewage, where undoubtedly many oxidizing and reducing systems, both reversible and irreversible, are concerned, it is unlikely that a simple, direct, theoretical explanation of the oxidation process will be forthcoming. Further, it does not seem apparent that present knowledge of the subject justifies unqualified statements regarding exact potential values for the aerobic and anaerobic portions of the treatment process."

John W. Hood—"Measurement and Control of Sewage Treatment Process Efficiency by Oxidation-Reduction Potential;" Sewage Works Journal, July, Pp. 640-653.

Explosions in Underground Structures

Explosion in a manhole, closed tank or other underground structure may occur if the atmosphere contains a mixture of flammable vapor and air within certain limiting proportions, and there is a coincident source of ignition. The presence of flammable vapors may be due to fuel gas leakage, escape of natural gas from oil fields, gases from substances improperly discharged into sewers, leakage from pipe lines carrying petroleum products, or escape of refrigerants. Flammable "sewer gas" may be due to cleaning solvents, drainage from garages, and industrial wastes containing carbon disulfide, ammonia, calcium carbide sludge, sodium or potassium chlorate or perchlorate. Preventive measures listed by the author are: 1—Periodic tests of the atmospheres of all manholes and vaults for detection of combustible vapors. 2—Ventilation, by forced draft where necessary. 3—Survey to detect presence of combustible gas in the soil around sewer lines. 4—Flushing and cleaning sewers to prevent deposits of organic material. 5—Periodic inspection of industrial plants to prevent discharge of wastes that might produce explosive gases due to physical or chemical impurities or high temperatures. Employees should be trained in detecting and remedying dangerous conditions. Ordinances should be passed and enforced for preventing the discharge into sewers of wastes likely to produce explosive atmospheres.

Special report of a committee of Board of Public Works, Los Angeles, Calif., Sewage Works Journal, July, Pp. 665-678.

Pollution of Waters By Industrial Wastes

The adverse effects of pollution may involve hygienic, economic, aesthetic and legal considerations. The hygienic are the most important. Present deplorable conditions are due partly to the opinions of public health engineers that complex and costly water purifica-

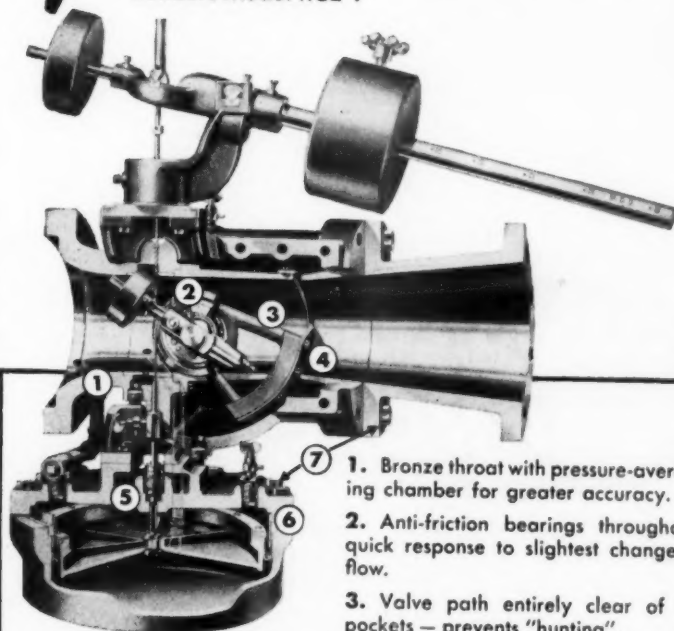
tion plants are a more effective and economical safeguard to public health than sewage treatment. Among the economic factors are cost of purifying water supplies, damage to structures, destruction of fish life (Pennsylvania in 1946 collected \$920,000 for fishing licenses), impairment of the value of riparian property, and silting of reservoirs and navigation channels (silting of the lower Schuylkill river necessitates dredging costs that justify an expenditure of \$12,500,000 to prevent it). It is impossible to evaluate economically conditions offensive to sight and smell. The political aspect is suggested by the fact that in 1946

11,068,717 fishing licenses and 9,854,313 hunting licenses were bought in the United States. In at least two states, conservation and stream pollution were important issues in gubernatorial campaigns. There should be organization at a local level of technical representatives of the various industries to disseminate and encourage exchange of knowledge, collect data, and assist governmental agencies in establishing and evaluating standards of treatment and of water quality, and subsidize basic research.

Roy F. Weston, San. Engr., Atlantic Refining Co.; Sewage Wks. Jour., July, Pp. 682-686.

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Performance of High-Rate Filters

The author analyzes the results obtained by high-rate filters as reported by Walton (Upper Mississippi Basin) and the National Research Council. He found that filters about 6 ft. deep, with loadings up to 720 lb. per acre-ft. and including the secondary settling tanks, removed 85 to 92% of the applied B.O.D. Nitrification was found up to a loading rate of 377 lb. per acre-ft. but fell off at 429 lb. Recirculation permitted loads to be increased from 429 to 1170 lb. per acre-ft. with only 1.5% reduction in B.O.D. removal. Two-stage filtration permitted increasing the load several hundred percent, but most of the work was done in the first stage. For loadings up to 2000 lb. per acre-ft., shallow filters with 280 to 1050% recirculation produced around 90% overall reduction. (A mathematical analysis indicates that 800% recirculation gives the maximum possible increase).

None of the filters loaded at over 2000 lb. of B.O.D. produced nitrification. "There is a fallacy in using only the 5-day B.O.D. to measure the results accomplished. For many conditions of disposal, however, a nitrified effluent is unnecessary, and for such conditions intermediate grade effluents will suffice." They may be satisfactory for Army camps, but are they for permanent use in municipal installations?

In discussing this paper, W. A. Hardenbergh said: "It is likely that two-stage filtration will become more general, with the use of high-rate filters as roughing filters carrying a very heavy load, and with final treatment by secondary high-rate filters, low-rate filters or activated sludge."

F. W. Mohlman—"High-Rate Filter Performance;" Sewage Works Journal, July, Pp. 618-625.

Disposal of Milk Wastes

Whatever method is employed for treating milk wastes, difficulties are experienced in the form of high costs of construction, operation and maintenance, as well as in biological and chemical problems. The costs can be greatly decreased by decreasing the amount of waste to be treated, which is unnecessarily high. The author calculated that the wastes from one Indiana plant had a value of \$95 to \$916 a day, much of which loss could have been prevented. He believes that spills of products in dairy plants must be eliminated if the wastes are to be treated in facilities of economical size. Decreased cost of constructing and operating such plants will result from further study of economical construction and increased purification per unit of plant volume.

Don E. Bloodgood—"Milk Waste Disposal;" Sew. Wks. Jour., July, Pp. 695-706.

The dairy industry has recently organized a Task Committee on Dairy Waste Disposal, to distribute information on ways and means of reducing dairy plant waste; initiate studies of equipment design and plant layout, and economical methods for reducing waste; and educate dairy plant management on the importance of measuring and analyzing wastes. It classifies dairy wastes as those due to inefficient processing equipment, methods or operation; wastes of whey, buttermilk, skim milk or other by-products, of spoiled products, and those due to rinsings and wash water. In one plant a waste saving program reduced the B.O.D. wasted from 260.5 lb. per day to 73.4 lb. without replacing any equipment.

A. J. Steffen—"Milk Waste Disposal—A Discussion;" Sew. Wks. Jour., July, Pp. 707-708.

Treatment of Fiberboard Waste

The author has designed a plant for handling the waste liquor from a fiberboard plant processing 390 tons of wood pulp a day, estimated to contain 92,000 lb. of dry solids in 864,000 gpd. of effluent, and have a B.O.D. value of 64,700 lb. per day. The river which would receive the waste varies in flow from 270,000 cfs to 1,100 cfs, but about 2,500 cfs for 5 to 8 months a year. Assuming 960 cfs with 3 ppm of dissolved oxygen available at mini-

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mum flow for diluting these wastes gives 15,552 lb. of oxygen per day. Because of the stream characteristics below the plant it was assumed that satisfying 2-day B.O.D. would meet the requirements. This B.O.D. was estimated at 4,860 ppm or 34,943 lb. daily of oxygen, of which 15,552 lb. would be furnished by the stream.

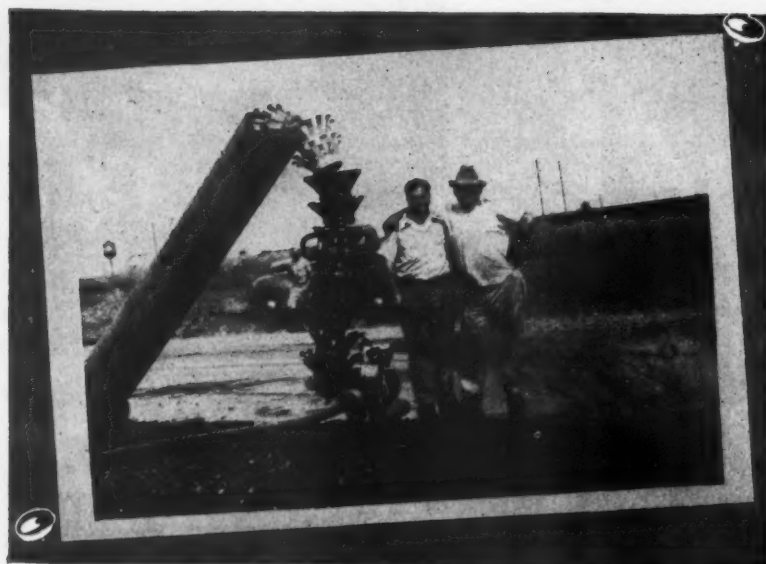
The waste carries practically no suspended solids and no organic matter that could be coagulated, so the available methods were biological filtration, activated sludge, anaerobic fermentation, and lagoons. Calculations had shown that the cost of anaerobic methane digesters would be only 7.45%

of that of trickling filters or 2.98% of that of sand filters, while activated sludge would be even more expensive and lagoons were found to be inadequate. Therefore study was made of how to apply methane fermentation. This waste does not contain the nitrogen necessary for this process and it is planned to supply this by adding anhydrous ammonia as the least expensive source. The nitrogen added is apparently fixed in the cell material and thus concentrated in the sludge, and returning this sludge to the digesters will reduce the amount of nitrogen to be added. With the correct amount of nitrogen added, estimated to be 100

ppm as ammonia, over 90% reduction of B.O.D. is possible. The plan adopted is to treat 70% of the waste by two-stage anaerobic digestion, discharging the other 30% untreated. When the river flow falls below normal, part of the waste will be lagooned, the lagoon waste being discharged during periods of high flow at a rate controlled on the basis of stream gauge reports, dissolved oxygen determinations and B.O.D. determinations.

A. M. Buswell and F. W. Sollo, Jr. —"Methane Fermentation of a Fiberboard Waste;" Sew. Wks. Jour., July, Pp. 687-694.

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New Winnipeg Incinerator Undergoes Severe Tests. By Sam M. Clarke, of Greeley & Hansen, Engrs. August, Pp. 394-397.
Electric Motor Drives in the Sewage Treatment Field. August, Pp. 399-403.

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Measurement and Control of Sewage Treatment Process Efficiency by Oxidation-Reduction Potential. By John W. Hood, Supt. of Sewage Treatment, Ridgewood, N. J. Discussion by Gerard A. Rohlich, Assoc. Prof., Univ. of Wisconsin. July, Pp. 640-653.

Effect of Sewage Concentration on the Attainable Degree of Purification by the Activated Sludge Process. By W. E. Abbott, Chemist, Sewage Disp. Dept., Nottingham, England. July, Pp. 654-656.

The Effects of Sewage Treatment Processes Upon Ova and Miracidia of Schistosoma Japonicum. By Walter L. Newton and Wm. B. Figgat, Div. of Tropical Diseases, U.S.P.H.S., and Samuel R. Weibel, San. Eng. Div., U.S.P.H.S. July, Pp. 657-664.

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Biochemical Oxygen Demand of Sulfite Waste Liquor. By Richard G. Tyler, Prof. of San. Eng., Univ. of Washington, and Sherley Gunter, Bacteriologist, Pulp Milk Research, July, Pp. 709-719.

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Failure of a Concrete Sewage Filter Tank. By W. Scott Willson, July 16, Pp. 365-366.

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Winnipeg's New Incinerator Passes Its Tests. Aug. Pp. 19, 20 and 24.

Sewage Treatment by Contact Aeration. By G. R. Herzik, Jr. Aug. Pp. 26, 27, 28 and 40.

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Trickling Filters for Treating Pulp and Paper Mill Wastes: Part 1—Alkaline Wastes. By Harry W. Gehm, Technical Adviser, Nat'l Council for Stream Improvement, July, Pp. 271-274.

without any kind of fish management."

Reservoir fish management may be beyond the reach of practical methods due to natural obstacles or prohibitive costs. Mr. Bennett says: "We have found it impracticable to attempt to remove undesirable fish by seining because of the stumps and brush that are commonly present in the bottoms of these flooded valleys. On strictly recreational waters, we have used rotenone for poisoning ponds up to 12 acres of surface area. This poison costs approximately 60 cents a pound, and the required amount to kill fish is approximately 3 pounds per acre-foot of water. With this cost accounting, it is readily possible to poison a 3-acre pond of average depth for around \$50; but above the 12-acre limit the cost of lake poisoning becomes too high."

According to the State Natural History Survey, rotenone used in quantities necessary to poison lakes is apparently not toxic to warm-blooded animals. However, in every case where farm ponds are poisoned, livestock is excluded and arrangements are made to provide water from other sources for a period of a week following treatment. It is interesting to note that in one case about a dozen cows broke through a fence and drank from a pond within 2 hours after the rotenone had been applied. No serious effects resulted from the accident. A small pig was purchased for test purposes and eventually poisoned, but it required half a pound of rotenone mixed with a quart of milk to kill the animal.

Even though there is some evidence that rotenone is not particularly poisonous, the practice of killing fish in water-supply reservoirs by the use of poisons is not considered advisable. As yet, there is insufficient evidence to ascertain that there would be no harmful effect when using rotenone-treated water over an extended period. First consideration should always be given to the safety of the water for drinking.

50 Questions & Answers on Radiant Heating

A pamphlet has been prepared by the Research Staff of A. M. Byers Co., Pittsburgh, Pa., which asks and gives the answers to 50 questions on this subject. These questions are grouped under: What it is; heating surfaces; piping; insulation; concrete floors; coil design; controls; and miscellaneous. Examples are worked out simply and clearly. This may not be off the press yet as we got an advance copy; but better write for it right now, for there is a lot of good dope in it.

Water Works Reservoirs and Fish Management

A discussion of this subject in the Summer Issue of *Over The Spillway*, publication of Illinois Division of Sanitary Engineering answers some of the questions concerning fish control in reservoirs that our readers sometimes ask us. Harlow B. Mills, chief of the Illinois State Natural History Survey and George W. Bennett of the same agency are quoted.

"For a good many years," says Mr. Bennett, "we have said that recreation and water supply do not go together, because at intervals of 5 to 10 years artificial lakes must be drained or the fish populations removed by poison and the lakes restocked with desirable fish in order that the lake may continue to produce good fishing and recreation in general. There are no methods developed at the present time that are suitable for removing fish from a water-supply reservoir, unless water-supply needs can be diverted to wells or other sources for a period of 3 to 5 weeks."

Use of Rotenone or Other Poisons

Regarding the use of rotenone, Mr. Mills remarks, "This material is a very effective fish poison and is rela-

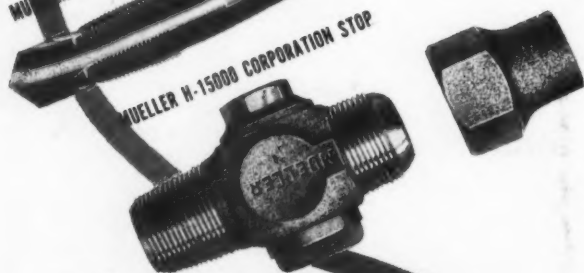
tively noninjurious to human beings when used as an insecticide on truck crops. I am not in favor, however, of the use of this material in a public water supply. In the first place we are not sure what its effect would be on persons using the water, and in the second place it is probable that all the fish killed would not be collectible and would develop a putrefaction problem."

To this, Mr. Bennett adds, "This insecticide not only stuns the fish but eventually kills them, and after they are poisoned there is the task of picking up the dead fish and hauling them away. In the middle of summer, when the water reaches its maximum temperature, the poison may disappear within a period of 4 to 5 days. There are several other poisons which might be used to eliminate fish from a lake, but all of them would be more toxic to humans than rotenone and their use would be entirely impractical in a water-supply reservoir; therefore, sportsmen and sportsmen's organizations that depend on water-supply reservoirs for recreation are forced to be satisfied with the type of fishing that these reservoirs furnish

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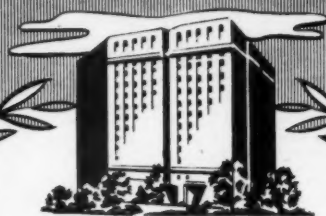


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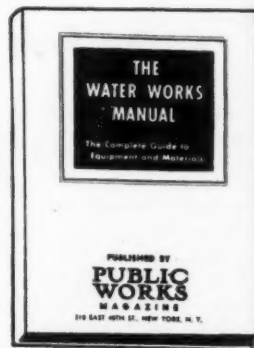
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Refuse Disposal in Maryland

THE following data on refuse disposal are from the 1947 report of the Maryland Bureau of Sanitary Engineering of which George L. Hall is chief engineer.

The Reedbird Avenue incinerator of Baltimore City, which has a rated capacity of 600 tons per day, consumed a total of 147,089 tons of garbage and rubbish of which 39.6 percent was garbage and 60.4 rubbish. The ash from the incinerator averaged 1.35 percent combustible material with maximum and minimum monthly averages of 2.51 percent and 0.32 percent, respectively. For the year an average of 481 tons of mixed garbage and rubbish were consumed daily which represents an average capacity rating of 80 percent. The total cost of operation for the year was \$1.91 per ton of material consumed and the net cost, after crediting revenue from the sale of salvable material, was \$1.65 per ton.

Baltimore City continued the sanitary landfill operations at the site in Herring Run Park. A total of 190,034 tons of garbage, rubbish, ashes, and street dirt was placed in the fill during the year, of which 23.6 percent was garbage, 43.8 percent rubbish and 32.6 percent ashes and street dirt. The total volume of the material placed in the fill was 296,080 cubic yards which was spread over an area of approximately 12 acres. Since the beginning of sanitary landfill operations in Baltimore City in April, 1944, and through 1947, a total of 978,190 cubic yards of garbage, rubbish, ashes and street dirt has been placed in the landfill. The

cost of disposing of the material for 1947 was \$0.424 per ton.

A total of 23,634 tons of garbage and rubbish, or about 80 tons per day, was consumed at the 150-ton incinerator at Lyttonsville in the Washington Suburban Sanitary District. The total cost of operation was \$3.48 per ton.

The 70-ton incinerator at Bladensburg, also operated by the Washington Suburban Sanitary Commission, destroyed a total of 12,892 tons of garbage and trash or about 35 tons daily, at a total cost of \$3.45 per ton.

The Annapolis incinerator, which has a capacity of 60-tons per day, burned a total of 5,423 tons of mixed garbage and trash during the year. This plant has been operating for more than two years without the use

of any auxiliary fuel. The cost of incineration during the year, exclusive of capital charges, was \$1.41 per ton of material burned.

The 3-ton per 24 hour incinerator at Rising Sun is operated several days each week but no records are kept of the quantity of garbage and trash consumed. This plant serves a community which has a population of 529 persons. Operation of the incinerator is very satisfactory.

Force Account Road Construction in Alabama

The illustrations herewith show road construction with county-purchased and county-operated equipment. One picture shows the equipment operated by Clarke Co., Ala., on a 6-mile project between Jackson and Coffeeville, which includes grading, drainage and a double-surface black-top. On this job are three International crawler tractors; one is



Tractors and scrapers used in road work by Clarke County

being used with a Bucyrus-Erie bulldozer, and the others with LeTourneau wheel scrapers. John A. Bridges is county engineer, Judge Coma Garrett is chairman of the County Commissioners and Judge of Probate; W. L. James is Job Superintendent.

The other picture shows an International I-9 tractor owned by Choctaw County pulling a double drum sheepfoot roller on a 11-mile Farm-to-Market Road between Gilbertstown and Melvin.

Industries Contribute for Sewage Treatment

A local canning company and a milk products plant have agreed to contribute approximately \$45,000 toward the cost of a new sewage disposal plant for Elkhorn, Wisc.



Wheel tractor and sheepfoot roller, Choctaw County

The Water Works Digest

Cathodic Protection Of Steel Water Tanks

Three types of electrical devices are being offered for mitigating corrosion in steel tanks—cathodic installations in which a direct current from an external source, impressed on either (1) a sacrificial or (2) a non sacrificial anode, flow through the water to the wall of the tank; and (3) an electrodeless installation, in which a system of electrical resistances is attached to the outside of the tank and a direct current applied from an external source flows through the resistances into the wall of the tank. A test of these three was conducted by the author, using 18" lengths of 10" steel pipe, sandblasted clean, and drained and filled daily. An aluminum anode was hung in one and a galvanic magnesium anode in another, while the third was provided with an electrodeless installation. A fourth with no protection was used as a control. The tanks were operated for 5½ months, the influent and effluents being analyzed three times a week for pH, turbidity, color, alkalinity, dissolved oxygen, and total iron pickup.

The results secured during this investigation demonstrate cathodic protection to be a practical method of protecting the submerged steel surfaces of water storage tanks.

1. The use of a properly installed sacrificial aluminum anode provided with an external potential was found to prevent adequately the corrosion of a bare steel surface.

2. The use of a properly installed sacrificial galvanic magnesium anode was found to inhibit the corrosion of a bare steel surface despite an initial aggressive attack.

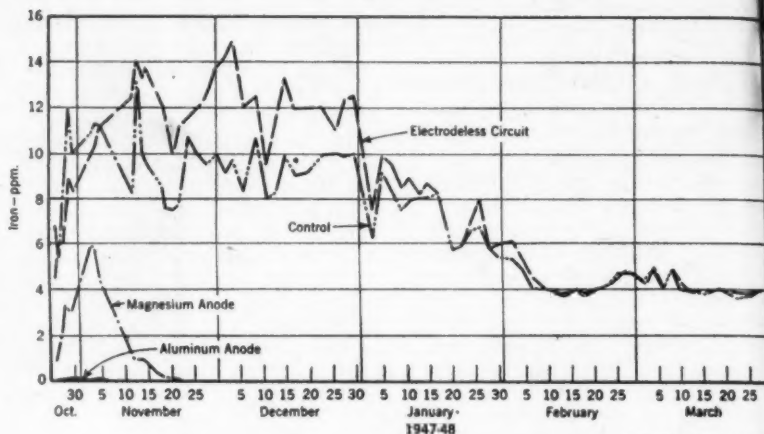
3. The electrodeless circuit, frequently referred to as a cathodic protection, showed no protection against corrosion. This conclusion is in agreement with that reached after 31 months of an actual field investigation.

4. The dissolved oxygen concentrations in the stored water were not found to increase when sacrificial anodes, either of the galvanic type, such as magnesium, or aluminum with an applied external potential, were used.

Peter E. Pallo—"Cathodic Protection of Steel Water Tanks"; Jour. A.W.W.A., July, Pp. 701-711.

Fluorine in Water Supplies

A few months ago Abel Wolman, in an article in the *Journal of the Am. W.W. Ass'n* (see *Waterworks Digest* for November, 1947) raised the question "Should public water supplies be used for mass medication?" Discussing this, Prof. Nichols objects to the



Iron pickup in tank effluent.

Courtesy Journal AWWA

use of the word "medication," believing that "supplementation" would be more correct. He says "There seems to be no valid reason why water low in fluorides should not be supplemented to the safe level of 1.0-1.2 ppm. . . . The supplementation of drinking waters deficient in fluorides for mass protection against dental caries is an advance in public health practice second only to the control of enteric fevers by water chlorination."

M. Starr Nichols—"Supplementing Water Supplies with Fluorine"; Jour. A.W.W.A., July, Pp. 751-753.

California's Water Shortage

"The southwestern portion of the United States is in the midst of the greatest drought in history," due to war industries and growth of population, with increased use for industrial, irrigation and domestic purposes. Various methods are proposed for preventing the continuance of recurrence of the present condition. The author gives reports from eight communities, citing the methods adopted by each for curtailing use. Some confine these to irrigation, restricting this to every other day, 3½ days a week, etc.; forbidding use on lawns or annual plants, washing automobiles by hose, washing walks, driveways, etc. One district encourages owners of private wells to use water from the mains during low-demand periods and so conserve ground water for the summer peaks. The manager of the Vista Irrigation Dist. believes water rates should start low and rise as the quantity used increases, and so regulate rates as to encourage use in the period prior to that of peak demand. In the southwestern coastal area

of Los Angeles County, the ground-water plane has fallen from 30-40 ft. above sea level to 30-75 ft. below it during the past 40 yr., and all wells within 1½ miles of the coast now suffer salt water intrusion and the saline front is encroaching at a yearly rate of 500-1,000 ft.

Oswald A. Gierlich—"Meeting the Southwestern Water Shortage"; Jour. A.W.W.A., Pp. 766-770.

Not only is ground water in California decreasing in quantity, but it is being polluted by industrial wastes and sewage, and the State Assembly has created a committee to investigate the matter and prepare legislation for presentation at the 1949 session of the legislature. This committee has already verified the fact that serious water pollution is common all over the state.

Roy O. Van Meter—"Investigating Water Pollution in California"; Jour. A.W.W.A., July, Pp. 784-786.

Effect of the Sun on Precipitation

It has been demonstrated that variations of the sun's radiation and of sunspots occur. Both show periodic fluctuations. Both affect weather on the earth. The variations of solar radiation are major causes of weather changes, producing large departures from the normal in temperature and precipitation. For some stations these effects are, to some degree, predictable far in advance. For other stations, the effects are so confused by the complexities of the atmosphere and the earth's surface as to be thus far unpredictable. Rough predictions from a 273-month cycle have shown considerable success for some stations but not for all localities. Detailed statistical forecasts for years

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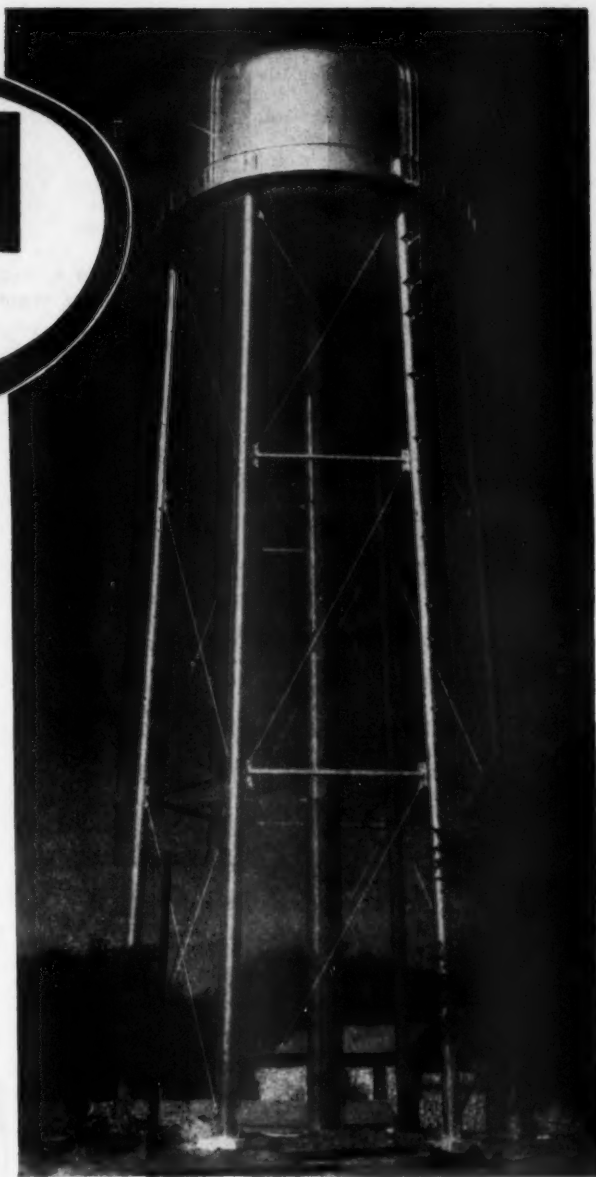
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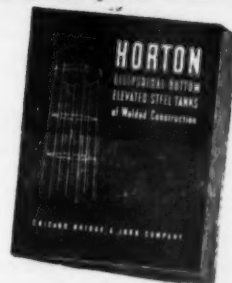
Horton tanks are butt-welded throughout. There are no rivets used, no caulking, and there is no leakage from the seams. The welded construction makes it possible to keep corrosion at a minimum by eliminating sharp edges and inaccessible corners or crevices where dirt might collect. Horton tanks are graceful structures, with smooth, curved surfaces and simple details.

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Detroit 26	1536 Lafayette Bldg.	Seattle 1	1339 Stuart Bldg.
Houston 2	2142 National Standard Bldg.	Tulsa 3	1641 Hunt Bldg.

in advance have given excellent results at some stations but are very tedious. Enrique J. Montouliou, on the basis of a calculated 9.93-year cycle for Cuba, predicted the 1938 drought a year in advance. Sunspots do not appear to be major weather elements, but their effects may be greater than is now known.

C. G. Abbott—"The Sun and Precipitation"; Jour. A.W.W.A., July, Pp. 755-762.

Watershed Forestry

The prime objective in the management of a watershed forest is to protect and build up the forest floor as a supplementary reservoir. This can be accomplished as well by commercial species of trees as by weed species, and there are no areas in public ownership on which forest management can be employed to greater advantage. Special attention must be given to protection against fire, insects and tree diseases. The first is effected by patrol, removal of hazards, and by roads, trails and waterholes. Patrol is the most effective and economical. Hazards often include open fields of broom grass, town dumps and abandoned buildings.

Knotty pine lumber is worth about \$50 a thousand, clear lumber about \$150. By pruning the limbs from white pines when they are 2" to 4" in diameter at breast height, clear lumber can be obtained for a height of 17 ft. Weed

species of trees can be cut out by one man with a machete at the rate of one acre a day. This and the removal of deformed and diseased trees may double or triple the growth per acre of merchantable trees.

Harris A. Reynolds—"Work of the New England Forestry Foundation on Watersheds," Jour. N.E.W.W.A., June, Pp. 133-140.

The A.W.W.A. Policy Re. Nation's Water Resources

The Board of Directors of the A.W.W.A. has approved, as the formal policy of the Association, a statement embodied in 7 paragraphs, which, in a condensed form are as follows: (1) Information concerning the location and capacity of the nation's water resources is, at the present time, not adequate, and should be increased as fully and promptly as possible. (2) It approves the broad program of the U. S. Geological Survey, and (3) the studies of ground water resources made by it in cooperation with the various states, or (4) with political subdivisions within the states where there are no appropriate state agencies. (5) Drilling of test wells or other wells should not be done by equipment owned by either the U.S.G.S. or the state agencies, unless there are no competent private drillers willing or able to contract to do this work; (6) on the broad underlying principle that the

extension of federal or state activities into areas of action where private industry is competently prepared to serve the public need is undesirable and not in keeping with the nation's economic background. (7) States, cities and private well owners and drillers should file with state agencies and the U.S.G.S. all well log data and production records which they possess.

Report of Committee on National Water Policy, Jour. A.W.W.A., July, Pp. 693-699.

Allowance For Hurricanes

Maximum rainfall intensities are predicted as a basis for designing capacities of spillways and for some other reasons. These predictions are generally based on long-time records, and in the United States these can be fairly well represented by curves. But in the tropics, the records for hurricanes lie entirely outside of such curves. Records at Havana, Cuba, for 21 years show a maximum intensity for five hours of 0.62" per hr., but the 1926 hurricane had a 5-hour intensity of 2.8" per hr. or 14" in 5 hr. An earth dam spillway based on the 21 year record with a factor of safety of 2 would have been fatally inadequate.

Louis Radelat—"Rainfall Intensities in Havana"; Jour. A.W.W.A., July, Pp. 763-766.

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Laying Water Mains on Sewers

Brookline, Mass., about 25 years ago began laying its storm sewers on top of the sanitary sewers, the two being encased in a concrete structure with a minimum thickness of 6" on all sides. Several years later the water department began laying its mains on top of this structure because of the solid foundation and economy in trenching, the water department paying 1/3 of the cost of the trenching. Where the distance between top of sewer structure and street surface is between 5 and 7 ft. the main is laid directly on the sewer structure. Where the depth exceeds 7 ft.,

concrete or brick piers are used or gravel fill under the pipe. In laying house connections, water and gas service pipes are laid on shelves on either side of the trench in which the sewer structure is laid.

Kenneth W. Robie — "Distribution Pipe Problems," Jour. N.E.W.W.A., June, Pp. 122-125.

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Catholic Protection of Steel Water Tanks. By Peter E. Fallo, Asst. San. Engr., Hackensack, N. J., Water Co. July, Pp. 701-711.

Future Trends in Water Rates. By Albert P. Learned, Asst. Engr., Black & Veatch, Cons. Engrs. July, Pp. 712-714.

Studies of Properties of Sulfur Jointing Compounds. By W. W. Duecker, Texas Gulf Sulphur Co.; James W. Eestep and M. Glenn Mayberry, Fellows, Mellon Inst. of Industrial Research; and J. W. Schwab, Texas Gulf Sulphur Co. July, Pp. 715-725.

Bacterial Oxidation of Sulfur in Pipe Sealing Mixtures. By Lloyd R. Frederick, Research Fellow, Rutgers Univ., and Robert L. Starkey, Research Specialist in Microbiology, N. J. Agricultural Experiment Station. July, Pp. 729-736.

Supplementing Water Supplies With Fluorine. By M. Starr Nichols, Prof. of Sanitary Chemistry, Univ. of Wisconsin. July, Pp. 751-754.

The Sun and Precipitation. By C. G. Abbott, Research Assoc., Smithsonian Institution. July, Pp. 755-762.

Rainfall Intensities in Havana. By Louis Rodelat, Engr. in Charge, Sanitation Works, Public Health Dept., Havana, Cuba. July, Pp. 763-765.

Meeting the Southwestern Water Shortage. By Oswald A. Gierlich, City Engr. & Water Supt., Manhattan Beach, Calif. July, Pp. 766-770.

The Proper Development of Ground Water. By E. W. Bennison. July, Pp. 771-774.

Policies and Problems in Controlling Ground Water Resources. By H. T. Critchlow, Chief Engr., Division of Water Policy and Supply, New Jersey. July, Pp. 775-783.

Investigating Water Pollution in California. By Roy O. Van Meter, San. Engr., Dept. of Water & Power, Los Angeles. July, Pp. 784-786.

The Missouri Basin Program and Municipal Water Supplies. By S. J. Ware, Bureau of Reclamation of Montana. July, Pp. 787-790.

New Intake Installation at Kodak Park, Rochester, N. Y. By Allen C. Bailey, Water Development Engr., Kodak Park. July, Pp. 791-795.

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Steel Drum Crib for Cleveland Intake. By A. A. Burger, of Havens & Emerson consulting engineers. Aug. 5, Pp. 76-79.

California Must Conserve Water. Aug. 5, Pp. 90-92.

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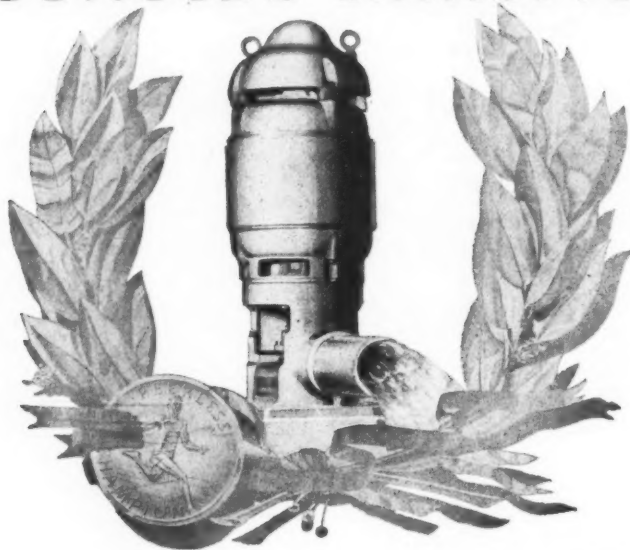
Public Works

Unusual Water Distribution System at Flin Flon. By M. A. Roche. Aug. Pp. 21-25.
Diesel Engine Standby for Water Works Pumping. Aug. P. 25.

Tacoma Lays 4 Miles of 58" Pipe. By A. R. McPherson. Aug., Pp. 29 and 50.

Laying a Water Pipe Under a 4-Track Railroad. By J. Warren Lawrence. Aug. P. 44.

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When you need special information—consult the READERS' SERVICE DEPT. on pages 77-81

Water and Sewage Works

Operation of Small Water Filtration Plants: VI—Disinfection. By A. E. Clark, Manager Nashville Suburban Utility District. July, Pp. 253-254.

Cleveland's New Water Intake. By Frank J. Schwemler, Construction Engr., Dept. of Public Utilities, Cleveland, O. July, Pp. 265-266.

Water Works Engineering

Water Supply System for Large Rural District in Holland. By F. A. Lieftrink, Chf. Engr., State Inst. for Water Supply, The Hague, Holland. August, Pp. 724-726, 762.

Tests Shed New Light on Cathodic Protection. By Peter E. Pallo, Asst. San. Engr., Hackensack Water Co. August, Pp. 728-730, 766.

Metering Urged for New York City to Avert Water Shortage. August, Pp. 727, 760.

Forty Years of Chlorination of Public Water Supplies Reviewed. August, Pp. 733-734, 769.

Cross Connections. By Angus D. Henderson, Civ. Engr., Dept. of Water Supply, Gas, & Elect., New York City. August, Pp. 739-740, 761.

Automatic Control of Pumping Using Both Flow and Pressure. Pp. 742-743.

Controlling Tastes and Odors Due to Algae

Experiences in taste and odor problems at Faith, S. D., were reported in the *Clarifier*, publication of the State Sanitary Engineering Division. The source of water supply is an artificial lake some 3 miles distant. Hot weather resulted in a heavy growth of algae which, almost overnight, was reflected in the quality of the water. Quick action by the operator, M. T. Heckmiller, with treatment of a large portion of the lake with copper sulfate, killed the algae; however, some of the dead organisms persisted for a few days. The Division of Sanitary Engineering helped in setting up an emergency activated carbon feeder, which quickly eliminated the tastes and odors.

Maintenance of Federal Aid Highways in Cities

According to information gathered by the Highway Research Board concerning the responsibility for maintenance of primary Federal Aid Highways within the limits of incorporated cities, 21 states have definite authority to maintain such highways at state expense. These states are not confined to any section of the country but include 2 in New England, 5 on the Atlantic coast, all 3 on the Pacific coast, 3 of the 5 North Central, 3 of the 4 South Central, and 5 of the 19 West Central and Mountain states. Three other states have such authority implied. The others have such authority, with some limitations, these chiefly based on population in 12 states, limited to cities under 2500 in most cases. In some states cities may perform the maintenance,

the state paying the city \$350 per mile per year in Iowa, and \$250 in Kansas. In Pennsylvania the regulations are quite definite, varying with the size of the city; in 1st Class cities the state maintains all such streets except for curbs, footways, and snow removal and street cleaning, the city paying part in some cases.

Complete Water Treatment Plant for Faith, S. D.

A treated surface water supply has replaced the former inadequate well

supply at Faith, S. D. The well supply was lacking in quantity and undesirable in chemical characteristics. The new plant consists of an Accelerator upflow type coagulation and settling basin, recarbonation, two gravity rapid sand filters, clear well, chlorinator, low and high-service pumps and chemical feeders. The capacity of this new plant is 100 gpm. The installation of an elevated storage tank eliminated troubles due to lack of pressure in the distribution system. These data are from the *Clarifier*, issued by the State Sanitary Engineering Division.



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PUBLIC WORKS Equipment News

Bituminous Concrete and Aggregate Spreader

This is a handy piece of equipment designed to do the many small jobs that formerly could be done only with lots of hand labor. It can be used with any conventional dump truck for spreading



Concrete and aggregate spreader.

slag, broken stone, sand, cinders, etc., on highways, streets, sidewalks, parking lots, driveways, etc. An outstanding and valuable feature is that, regardless of the roughness of the base, the spreader moves on an even plane, leaving a smooth surface for rolling. It spreads from half an inch to 8 ins. thick and is said to cut hand labor costs 90%. There is a good 4-page folder available. *Miller Spreader Corp., 120 Pike St., Youngstown 2, Ohio.*

Hyster Tractor Equipment

The illustration herewith shows a shovel attachment for the Hyster. It is equipped with a ½-yd. bucket and mounted on a D7 Cat tractor. Dragline, crane, clamshell or hoe can be attached. A crane unit like this was used for unloading steel pipe by the Latex Constr. Co., Atlanta, Ga. In a congested working area where the cars had to be spotted carefully and separately, 3 cars of 25 pieces of pipe, each 20" diameter and 40 ft. long, were unloaded in 3 hours. On another job, 18 cars of 10" by 40" pipe were unloaded in 9 hours. A "Hyster Reference Book" of 72 pages of photographs and data is available. *Hyster Co., Portland 8, Oregon.*

Sludge Filters for Sewage Treatment

The actual cost of a vacuum filter and an appropriate building for housing it is about the same as for the construction of sand drying beds, but real savings are realized in labor costs. Data on vacuum filters are contained in a new folder "The Vacuum Filter in Your Home Town," which has just been issued by The Eimco Corp., Salt Lake City 8, Utah. A copy will be sent on request.

New Shovel-Type Trench Excavator

Here is a new-type, light trencher, which will dig between obstructions; dig while moving in reverse; dig under sidewalks, curbs or buildings; and cut through roots up to 4" in diameter. It is equipped with an overload safety clutch and shear pins so that no damage results when a pipe is struck or the shovels hook onto a large rock. A sight and grade holder permits correction for ground variations, so that grade can be maintained within a fraction of an inch. Standard machines have a digging range of 7" to 16" in width and up to 6½ ft. in depth; attachments permits 24" width and 11' depth. Full track models have a loading of 3.0 lbs. per sq. inch; half-track and pneumatic mounted, higher pressures. For fuller information, write *Badger Machine Co., Winona, Minn.*

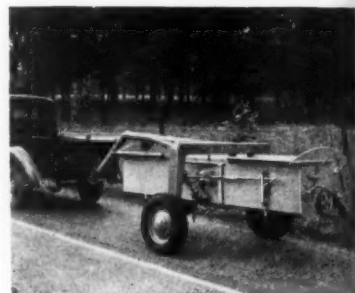
Safe & Easy Transporter for Spreaders

Easy, safe and fast loading and transportation of stone or chip spreader boxes is provided by this unit, on which 9 to 12-ft. boxes can be trailed at full speed behind any light pick-up truck.

One man can load a spreader on this transporter in, it is said, 1½ minutes. Unloading is equally simple. *Highway Special Equipment Co., 2040 Wilson Road, Hilliards, Ohio.*

Leaf & Litter Collector

The hopper of this unit will carry as much as 10 or 12 truck loads of uncompacted leaves; will pick up and handle glass bottles, small stones, branches, water soaked leaves, etc. It has a special vacuum snout for use under and around parked cars, sharp corners and driveway entrances, this being mounted on a free-wheeling tricycle

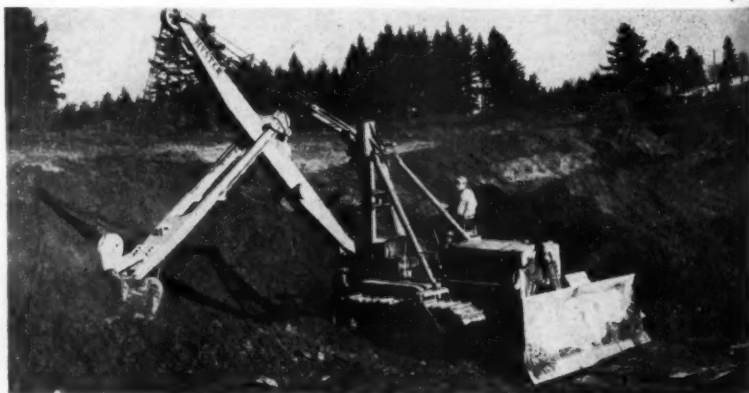


Carrier for spreader boxes.

carriage. Dumps load in 1 minute. Technical information is available from *Good Roads Machinery Corp., Minerva, Ohio.*

New 3-Fuel LeRoi Engine

This new engine, the H-540, delivers up to 135 hp., runs on gasoline, butane or natural gas, and is compact, easily accessible and light in weight. Specification sheets are available from *LeRoi Co., 1706 S 68th St., Milwaukee 14, Wis.*



Hyster "Hystaway" with ½-yd. Esco bucket on Cat D7 Tractor.

Syntron Vibratory Vertical Bowl Feeder

This is something new. Applying electro-magnetic vibration to a bowl container produces a circular traveling



Something new in feeders.

and climbing motion of small pieces, parts or bulk powders. These climb up a small ramp inside the bowl. Small pieces can be fed one at a time, in single file in a predetermined manner; powders can be fed in extremely small quantities. The unit is operated from 110, 220 or 440 volt AC. Detailed information from Syntron Co., 660 Lexington Ave., Homer City, Pa.

Trench Loading Tables

A new 28-page booklet of "Trench Loading Tables" is now available to engineers and contractors. Complete reference tables provide adequate data and a quick, easy method of pre-determining loads and strength requirements for clay pipe. Tables show the estimated load according to pipe size, trench depth and width and type of backfill. Trench loads on pipe were computed by the widely recognized, standard "Marston" formula. For a copy, write to The Robinson Clay Product Company, Akron 9, Ohio.

For Dirt-Handling on Small Jobs

Hydraulic bucket control has been added as standard equipment to some of the Hough Payloader front-end shovels.



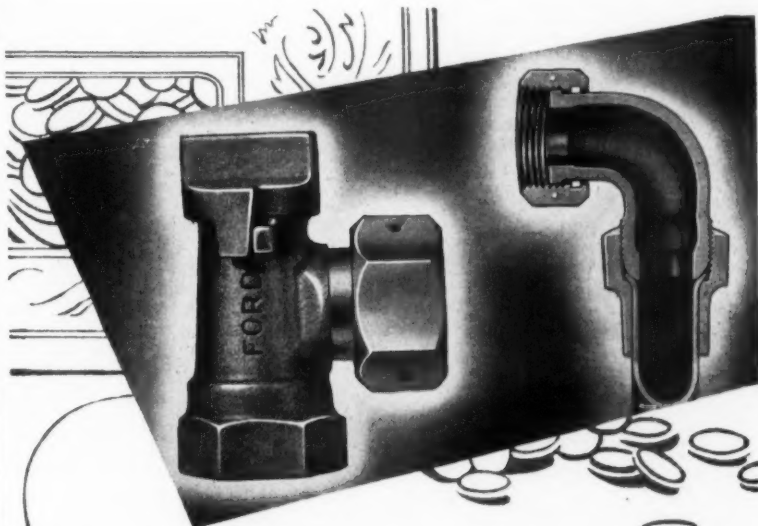
Hough HL shovel.

The Model HA has a 10½-cu. ft. bucket and the HL a 1¼-yd. bucket. The hydraulic control opens and closes the bucket, speeding up and making operation easier. New catalogs are available on both the HA and the HL, which units are designed for all types of public works construction. Write Frank G. Hough Co., 802-E Sunnyside Ave., Libertyville, Ill.

Digs as Much as 25 Men

This new trencher cuts clean trenches in soils of all types. It has adjustable clearance teeth and digs from 12" to 18" in width, or even wider. It can be set to cut any distance

down to 42" deep, and it travels from 1½ to 5 ft. per minute, depending on the depth and width of cut and the type of soil. A shifting lever permits use of standard tractor speeds, so that the unit can travel over curbs and up inclines, and maneuver quickly into working position. It can be moved from job to job under the tractor's power, or carried by a trailer. The trencher unit is mounted on a Ferguson tractor. It has been especially designed for digging foundations, and for trenching for water, gas, electric and sewer lines and will equal the pick and shovel work of 25 men. Full information from Everett Manufacturing Co., Inc., Phoenix, Arizona.



FORD RINGSTYLE VALVES and COUPLINGS

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The secret lies in the Ringstyle construction—a threaded coupling nut is pushed over a machined flange from the face side and then a bronze ring is driven into a groove in the nut and behind the flange, making a strong shoulder. These ingenious fittings really hit the jackpot when it comes to saving

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For complete information, send for Ford Catalog No. 46.

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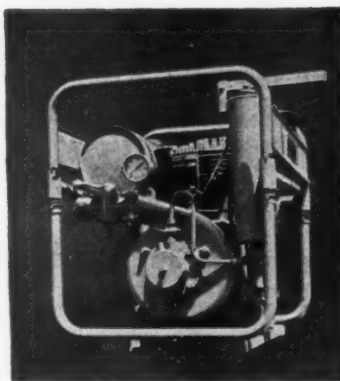
Wabash, Indiana

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Self-Powered 150-GPM Centrifugal Pump

This Hale, Model FZZ, centrifugal pumping unit has a capacity of 150 gpm. at 30 lbs. and 60 gpm. at 90 lbs. It can be mounted on a hand carrying frame, a barrow-type carriage, or on stationary supports. It is very compact—only about 2 ft. in largest dimension. Engine is 7.7 hp. Briggs & Stratton. It is designed for general service, including dewatering, emergency fire work, construction, etc. *Hale Fire Pump Co., Conshohocken, Pa.*



Hale fire pump.

Silicated Traffic Marking Paint

A silicated traffic marking paint, said to be many times as durable and resistant to cleaning as the usual paint, has been announced by *Wilbur & Wilham Co., Greenleaf and Leon Sts., Boston 15, Mass.* It is stated to have the additional safety feature of not being slippery.

"Featherweight" Aggregate for Concrete

Perlite is now being processed as a light-weight aggregate for concrete. Processed, it weighs from 3 to 12 lbs. per cu. ft., and is pure white. Concrete made with it weighs about half as much as standard concrete and has an insulating value 20 times as great. Processing

includes pulverizing and heat treatment. Bricks made from perlite will float in water. Full data on this interesting material from *Perlite Mfg. Co., Carnegie, Pa.*

A Super-DDT

A new non-staining insecticide that is claimed to be 10 times as powerful as DDT has been announced. This is called CD-68, and it contains chlordane, which has proven highly effective in insect control. The new insecticide leaves no visible residue and will not dull the finish or affect the sheen of polished surfaces. It is said to be less toxic to

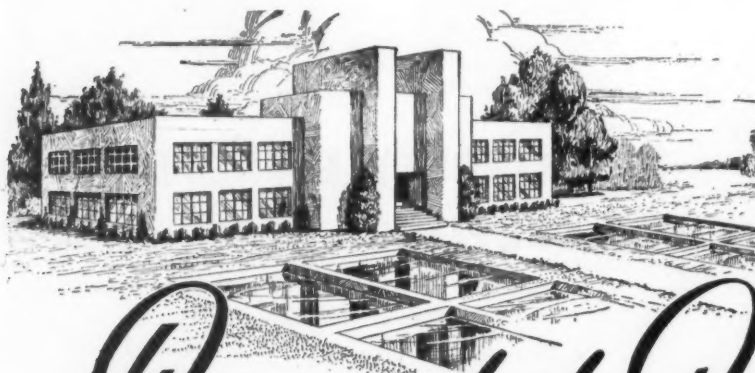
men and animals than DDT, though toxic is hardly the word to use in this connection. Full information from *Processed Chemical & Coatings Corp., 33 North 1 St., Brooklyn 11, N. Y.*

Texas Vitrified Pipe Company

The first complete year of production has just been noted by the Texas Vitrified Pipe Co. of Mineral Wells, Texas, of which J. F. Bailey is secretary and general manager. This plant is producing sewer pipe, drain tile, flue lining, stove pipe, wall coping, fire brick, septic tanks, fire clay, meter boxes, filter blocks and other special products. E. F. Clemens, who is president of the company, is also president of the Cannelton Sewer Pipe Co., Cannelton, Ind.

Flow Rate Kit for Research Work

This kit gives the research worker or the laboratory a unit that will measure 19 liquid flow ranges, starting at 0.1 cc per minute, and going up to 275 cc per minute. It will also measure gas flows, in 19 ranges, from 10 cc to 10,500 cc per minute. A data sheet is available. *Brooks Rotameter Co., Lansdale, Pa.*



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Catalogs and Bulletins

Brief and to-the-point mentions:
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Design Manual for Airport Pavements: This is a 32-page engineering manual covering the use of welded wire fabric reinforcement in airport pavement design. There are charts, tables, graphs and formulas. Covers also requirements for drainage and subbases. Sent on request. T. J. Kauer, Wire Reinforcement Institute, Inc., National Press Bldg., Washington 4, D. C.

For 2,4-D Spraying: A 4-page catalog describing lawn protective devices for use when spraying 2,4-D or other weed-killing chemicals. These are mostly small units. John Bean Mfg. Co., Lansing 4, Mich.

Laboratory Furniture.—Modern laboratory furniture and how to get it are shown in this catalog which illustrates standard units and how they can be assembled to meet most any needs. E. H. Sheldon & Co., Muskegon, Mich.

Small Engines.—Folders describe a $\frac{1}{4}$ to 1 hp. engine which weighs only 17 pounds, and is 9" by 11" by 14". Power Products Corp., Grafton, Wisc.

Welding Manual.—16-page booklet including data on resistance of Inconel stainless steel to corrosion. Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

Corrosive Fluids.—A new 4-page engineering bulletin, No. 97, gives detailed recommendations on construction materials for almost 400 different corrosive liquids and gases. This is purely a technical bulletin. Fischer & Porter Co., Hatboro, Pa.

Submersible Pumps.—Water intakes that may flood in high water can be equipped with these lake and river intake pumps. The motor is sealed; any of several centrifugal or turbine type pumps may be used. Bulletin 48-5250. Pump Division, Byron Jackson Co., Los Angeles, Calif.

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The Toughest Steel.—A 48-page construction bulletin shows the application of manganese steel to tractors, loaders, buckets, bulldozers, scarifiers, mixers, rope sheaves, pumps, etc. American Manganese Steel Co., Chicago Heights, Ill.

Packaged Generators.—This excellent 16-page booklet describes "packaged regulelectric generators" and gives data on selection for service, approximate power requirements, tables for

wire sizes and other information. Ask for Vol. 8, No. 3a of the Synchronizer. Electric Machinery Mfg. Co., Minneapolis, Minn.

Measuring and Controlling Flows.—This complete and technical catalog covers a quite complete line of rotameters for flow rate measurement and control; also an unusual instrument for laboratory work. Capacities, data sheets and dimensions are included for each type of meter. Ask for B-44648, Brooks Rotameter Co., Lansdale, Pa.

Trailer Mixers: Twenty-eight pages, Catalog M-8. Describes $3\frac{1}{2}$ end-discharge, tilting and non-tilting mixers; 6S, 11S, 16S, and power hoe plaster-mortar mixer. Jaeger Machine Co., Columbus 16, Ohio.

Truck Mixers: Catalog TM-8 describes the line of high-dump truck mixers, 2-yd., $4\frac{1}{2}$ -yd., and $5\frac{1}{2}$ -yd. 32 pages. Jaeger Machine Co., Columbus 16, Ohio.

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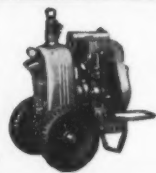
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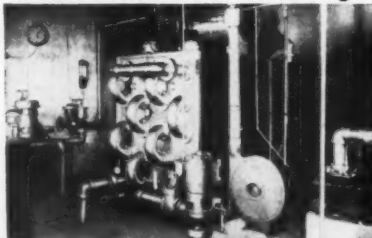
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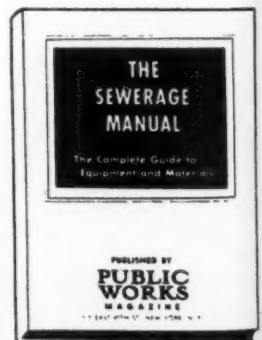
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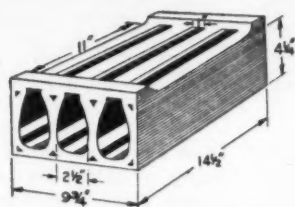
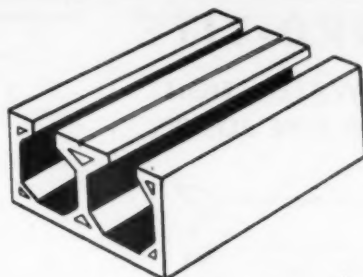
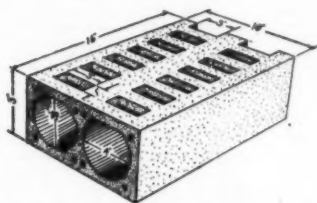
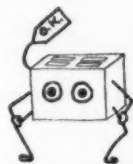
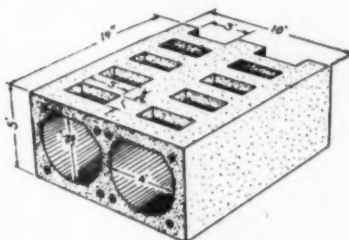


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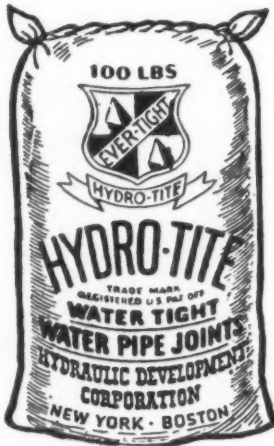
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16. There's no limit to the jobs you can handle with an Allis-Chalmers Package outfit consisting of the HD-5 Tractor with Tractor-Shovel and Model A-D Motor Grader. For booklets describing and illustrating these and other Allis-Chalmers Equipment write Dept. PW, Allis-Chalmers Tractor Division, Milwaukee 1, Wis.

Protect Your Grade Crossings With Model 10 Signals

45. Bulletin G17-PW6 describes and illustrates the automatically operated Model 10 railroad crossing signal. Folder describing this signal which guards against "second train" accidents and permits fast flow of rail and highway traffic is available on request from Western Railroad Supply Co., 2406-2436 South Ashland Ave., Chicago 8, Ill.

Save Time and Labor by Using a "Black-Topper"

46. The Etnyre "Black-Topper" is a bituminous distributor that will save you time and labor on the job. For bulletin giving detail of the accurate, dependable and economical performance of this distributor write Dept. P.W., E. D. Etnyre & Co., Oregon, Ill.

Speed Your Work With These Powerful Motor Graders

48. Two powerful Gallion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Gallion Iron Works & Mfg. Co., Gallion, Ohio.

Practical Portable Power Units for Every Need

49. M-M power units with heavy duty engine, positive lubrication, easy servicing, handy controls may be just what you have been looking for. Simple, durable, practical. Get latest bulletin from Dept. P.W., Minneapolis Moline Power Implement Co., Minneapolis 1, Minn.

Here's Your Diesel Tractor!

50. Big 48 page catalog describes and lists many uses for International Diesel Tractors. Write International Harvester Co., Dept. P.W., 180 North Michigan Ave., Chicago 1, Ill.

Need Street, Sewer or Water Castings?

51. Street, sewer and water castings in various styles, sizes and weights. Manhole covers and steps, inlets and gratings, adjustable curb inlets, water meter covers, cistern and coal hole covers, gutter crossing plates, valve and lamphole covers, etc. Described in catalog PW issued by South Bend Foundry Co., South Bend 23, Ind.

Latest Maintenance Equipment For Blacktop Roads

52. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

WATER WORKS

New Type Coating For Concrete and Steel

6. Zerok is a vinylite-type coating, acid and alkali protective, for any concrete or steel application in the sewerage or water works field. An 8-page folder tells where and how to use. Write Atlas Mineral Products Co., Mertztown, Pa.

Long Distance Recording of Level-Pressure-Flow

9. Be sure to get Bulletin 358 on the "Chronofio Telemeter" that brings accurate records of flow, level, pressure, temperature, gate positions, weight, etc., from widely scattered locations to a central operating point. Widely used in Water and Sewage plants. Write Builders-Providence, Inc., 16 Codding St., Providence 1, R. I.

A New Answer to Some Old Waterworks Problems

12. That is what they call "Hypo-Chlorination of Water," a 75-page illustrated discussion of this live subject, in a booklet packed with helpful information. For your copy, address: Mathieson Chemical Corp., Dept. PW, 60 E. 42nd St., New York 17, N. Y.

All About Cement-Mortar Lining of Water Mains

13. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centriline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

How Elevated Water Tanks Can Save on Operating Costs

14. Beautiful new booklet on Horton elevated steel water tanks suggests ways to reduce pumping costs, increase capacity of systems, maintain uniform pressure, etc. Illustrates 7 models of welded, ellipsoidal-bottom, elevated steel tanks in full color. Write Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4.

The Modern Way to Filter Swimming Pool Water

17. That's the title of a new bulletin full of facts about Bowser's new diatomite filter to produce clear, sparkling, clean water at low cost. Occupies small space, doesn't waste water. Gives sizes to use, performance charts, etc. Write Bowser, Inc., Dept. PW, Ft. Wayne, Ind.

Eliminate Taste and Odor From Your Water

53. Technical pub. No. P.W. 213 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor

USE COUPON ON PAGE 77 TODAY TO ORDER THE LITERATURE YOU NEED.

control of water with BREAK-POINT Chlorination. Send free to any operator requesting it.

Have You a Water Conditioning Problem?

56. Installation-tested equipment for complete municipal and industrial systems or individual units. Illustrated and described in latest booklets from Dept. P.W., American Wells Works, Aurora, Ill.

To Measure, Mix, Feed Chlorine or Other Gases

58. Everson SterElators. Bulletins 1063, 1066, 708 and others describe this device for measuring, mixing and feeding chlorine or other gases in solution. Capacities range from 1/4 lb. to 2,000 lb. of gas per 24 hours. Address: Everson Manufacturing Co., 214 W. Huron St., Chicago 10, Ill.

Hydraulic Pipeline Scraper For Water and Sewage Mains

59. For a copy of this compact folder on a hydraulic pipeline scraper which cleans all kinds of mains from 4 inches to 14 inches write to Dept. PW, Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Chem-O-Feeders for Automatic Chemical Feeding

60. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sani-

tation, treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioners, Inc., % Coddling St., Providence 1, R. I.

Find Buried Pipe and Leaks

62. Finding Buried Pipe, Leaks is easy with the new Featherweight Goldak Pipe Locator. An easy-to-read illustrated bulletin tells the full story quickly. Address: The Goldak Co., 1544 W. Glenoaks Blvd., Glendale 1, Calif.

All Kinds of Valves And Hydrants

63. Hydrants and Valves. Catalog P. W. covers fire protection appliances, including hydrants, gates and check valves. Catalog also describes sluice gates, shear gates, and flap, mud, gate, check and foot valves. Address: Mueller Company, Chattanooga, Tenn.

Helpful Data on Hydrants

64. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

How to Use Alum For Coagulation

70. Alum for coagulation in both sewage and water plants is the subject of literature now available from Dept. PW, General Chemical Division, 40 Rector St., New York 6, N. Y.

88 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 88 page booklet, W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

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ADVERTISING INDEX Now on page 76

Christensen Goes to Cornell

Dr. N. A. Christensen, dean of engineering at Colorado State College since 1938, has been appointed director of the School of Civil Engineering at Cornell University. He will succeed Prof. Carl Crandall, who has served as dean since the death of William L. Malcolm last winter.

Logan Joins Rutgers

Robert P. Logan, formerly assistant professor and research specialist of the Department of Sanitation, Rutgers University, has joined the staff of Dorr Co. as assistant to Dr. A. J. Fischer, chief sanitary developments engineer.

The Story of Huber

In observance of its 85th anniversary year, the Huber Mfg. Co., Marion, Ohio, has published a 16-page illustrated booklet. Designed to present the company's long history informally, the reader is taken on a tour of the plant by means of on-the-job pictures.

Engineers' Society of Western Pennsylvania

The ninth annual water conference of this society will be held at the William Penn Hotel, Pittsburgh, on October 18, 19 and 20. Detailed programs will be available soon. H. M. Olson, Ohio Salt Co., Pittsburgh, is chairman.

POSITION VACANT

The City of Keene, New Hampshire (14,000) is receiving applications for the position of Superintendent of Public Works. Department includes water supply and sewage disposal.

Applications should show education and experience in detail stating minimum acceptable salary. References desired. Applications will be kept confidential on request. Address Henry F. Goodnow, City Manager.

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Notice to Bidders:

Sealed bids addressed to the Mayor and City Council of the City of El Paso, El Paso County, Texas, will be received at the office of the City Clerk, City Hall, El Paso, Texas, until 10:00 A.M., Thursday, August 5, 1948, for construction of 8,750 lineal feet of concrete lined canal in conjunction with Storm Sewer Drainage Project.

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City Clerk

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